THE

AMERICAN BOYS'

WORKSHOP

THE AMERICAN BOYS' WORKSHOP

EACH SUBJECT BY AN EXPERT

Entirely Rewritten and Edited

BY

CLARENCE B. KELLAND

of "The American Boy"

PHILADELPHIA:
DAVID McKAY, PUBLISHER,
604-8 SOUTH WASHINGTON SQUARE

CONTENTS

BOOK I

PART I

The Outdoor Boy in Summer

PART II

The Aquatic Boy

BOOK II

PART I

The Indoor American Boy

CHAPTER IV

CHAPTER V

CHAPTER VI

CHAPTER VII

CHAPTER VIII

PART II

Miscellaneous Helps

CHAPTER I

CHAPTER II

CHAPTER III

PART III

Rope Work Every Boy Should Know

INTRODUCTION

THERE isn't a boy in the United States who has not some time started out to make something he needed very much. Possibly it was a fishpole, possibly it was a rowboat, possibly it was a desk for his room. Anyhow, he needed it, and tried to make it. For every boy who succeeded in turning out what he wanted there are a hundred who failed—and they failed because they didn't know just how to go at it. If they had had a hint or a few suggestions as to plan, or a drawing to follow, they would have built their fishpoles or boats or desks. And that is one of the reasons for publishing this book—to give the boy the help he must have to make what he needs.

The book has a dozen other purposes besides the mere giving of something interesting to read. Suppose, for instance, you are in camp, far from any town, and you find there are necessities of camp furniture you have forgotten. This book tells you how to make them right where you are. Suppose a rainy day comes along and you can't think of anything to pass away your time. This book will give you no end of suggestions. Possibly you want to make your father or mother a present: run through this book and you will find dozens of articles you can make at little cost. "The American Boy's Workshop" will help you in summer and in winter. It will help you at home or in the woods. It is the sort of book a boy wants to carry with him wherever he goes, because it contains something that will be useful or amusing to him wherever he is.

Nearly all the matter contained in "The American Boy's Workshop" has appeared in that excellent boy's magazine, *The American Boy*. It has been carefully re-edited and arranged, and is issued in this form by permission of The Sprague Publishing Company. The bulk of the chapters were prepared by John L. Dougheny for the "For Boys to Make" department in the magazine. Other chapters were written by specialists—men

especially fitted to take care of a certain subject. For instance, the chapter on "Signalling" was written by Lieutenant W. S. Anderson, of the United States Navy. The chapter on "Small Fur Bearers and How to Catch Them" was written by George J. Thiesen, a noted trapper and woodsman. The chapter on "The Bow and Arrow" is by A. Hyatt Verrill, and so on. So, you see, you are getting help not from one man alone, but from many men of wide experience, each writing about the thing he knows best.

It is hoped the book will bring pleasure to every boy who reads it, that it will prove valuable to him in his everyday plans, that it will help to strengthen his muscles, heighten his manhood, and contribute toward making him in every way worthy of bearing the name that forms part of the title of this book—an "American Boy."

CLARENCE BUDINGTON KELLAND.

BOOK I

THE BOYS' WORKSHOP

PART I

THE OUTDOOR BOY IN SUMMER

CHAPTER I

The Outdoor Boy in Camp

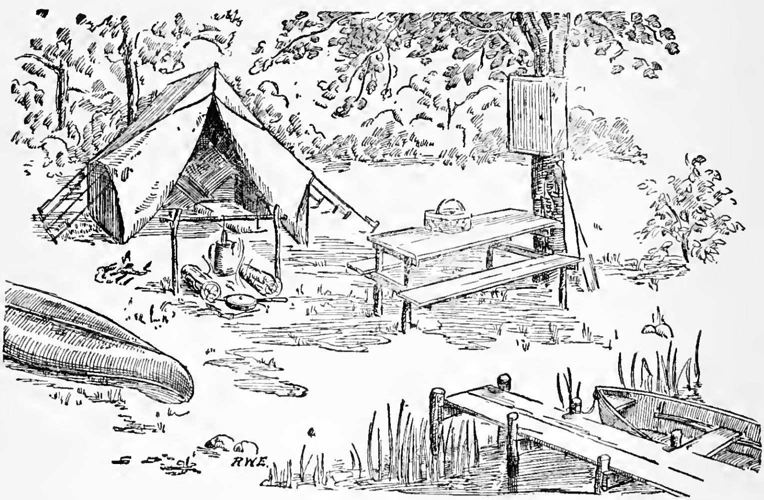
A CAMP

In the past few years people have awakened to the great value of fresh air, and camping, which was thought to be the folly of youth or the necessity of backwoods folks, has come into favor. Every available camping spot is being searched out and utilized. You need not go far away to camp. Boys have been known to pitch their tents on lawns and neighboring farms, in parks and academy grounds, to say nothing of some of the big city youngsters who are forced to choose the roofs of buildings for their open-air home.

The ideal camping ground is, of course, by the side of a lake or river. Make sure of your water supply and drainage, and have the open side face the south. The drawing shows the simplest outfit arranged in convenient style. The kind of tent used is called a wall tent. The poles used can be cut in the woods; the stakes and lines should be carried. The fire should be at least twenty feet away from the tent, to avoid danger of fire and inconvenience from smoke. The table erected near the tree will be found a luxury when compared with eating while squatted around the fire. The cupboard suspended from the tree near the

table contains dishes and salt, pepper, vinegar, etc. Do not keep sugar with the other food supplies or you will have all the ants in the country paying you a visit.

The outfit shown can be easily carried in a rowboat or canoe and can be set up by four boys in an hour. You will need an axe, fishing tackle, waterproof match safes, pliers, sharp knives, some peroxide and vaseline, clean cloths for bandages for scratches, extra pairs of shoes, sun hats, and pillows.



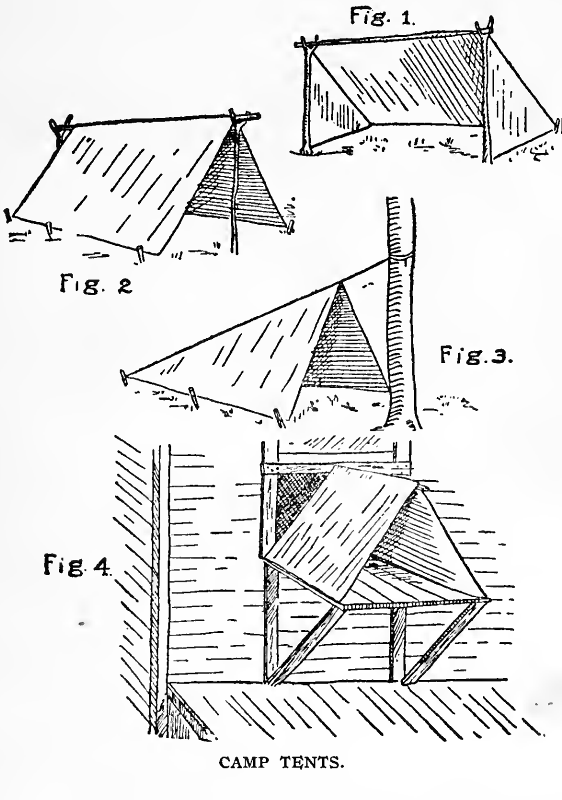
A BOYS' CAMP.

Here are a few sketches that will give the beginner an idea of how to set up a canvas quickly. Fig. 1 is the lean-to, and has two forked poles about six feet high in front and a cross-bar that rests upon them. A stake is driven at each of the rear corners for guying. The canvas for this style of tent should be of oblong shape, say about 18 x 8 feet.

Another very simple and practical shelter tent is shown in Fig. 2. It is used mostly as protection from the sun and the ends are open to admit the breezes. The same instructions as to canvas and poles that were given in regard to the lean-to hold good here; in fact, the material required for each tent is the same and you can

erect your shelter in the form of Fig. 1 or like Fig. 2, whichever suits your convenience best.

In Fig. 3 we have a simpler shelter than either of the foregoing. No poles are required and the canvas need not be of any particular shape, although a piece nearly square will be the handiest. This is



CAMP TENTS.

a tent that you can rig up very quickly on the bank of a creek when fishing, to keep your lunch cool and dry if a thunder storm happens to come along.

Figure 4 is a rigging for the home that enables the sleeper to have his head and shoulders out of doors. Doctors all over the country are unceasingly preaching fresh air and it behooves us

to heed their advice. It is best to begin to sleep outdoors in the summer, so that our system will be accustomed to it before the cold weather comes on. This shelter, supposed to be erected in the rear of the house, consists of a bracket shelf that may be bolted to the house, so as to admit of being readily removed. The canvas is erected in the manner shown or in any way that affords protection from dew, wind, and rain.

CAMP CHAIRS

The seats pictured here are so simple that they require little explanation on my part. They are designed for camping purposes, but there is no reason why you cannot make them for your lawn or playground; in fact, their rustic appearance makes

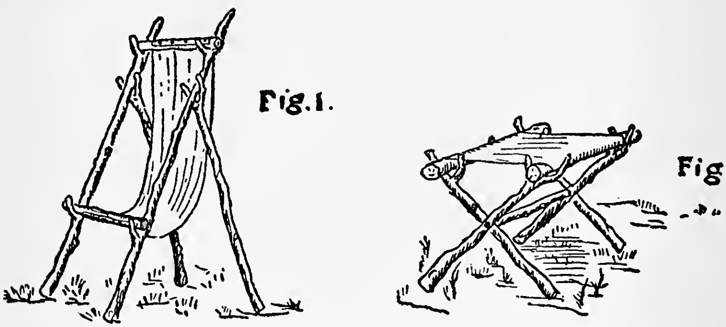


Fig.1.

Fig 2.

CAMP CHAIRS.

them as appropriate for a lawn as for any purpose I know of. It is an easy matter to find the pieces needed, but you should be careful not to strip your neighbor's trees of any branches, or your own, without permission from some of the older members of the family. Before attempting to drive long nails or screws in this green wood, bore holes with a small bit. Shave off all knots and bumps with a sharp knife and paint the spots with shellac or varnish to keep them from splitting. The chair and stool may be made in take-down style by tying the joints together with cord, and in this way can be taken apart and carried very easily. If made for the lawn it is just as well to screw them together

CAMP KITCHEN

Here is a picture of a camp cookery that ought to suggest a quickly arranged and quite convenient way of getting meals started while out roughing it. It is not easy to find a piece of suitable wire out in the woods, but no doubt you would have no trouble in locating a forked stick or enough of them to fill your needs. They are tied to the tripod with rope, but this lashing

CAMP KITCHEN.

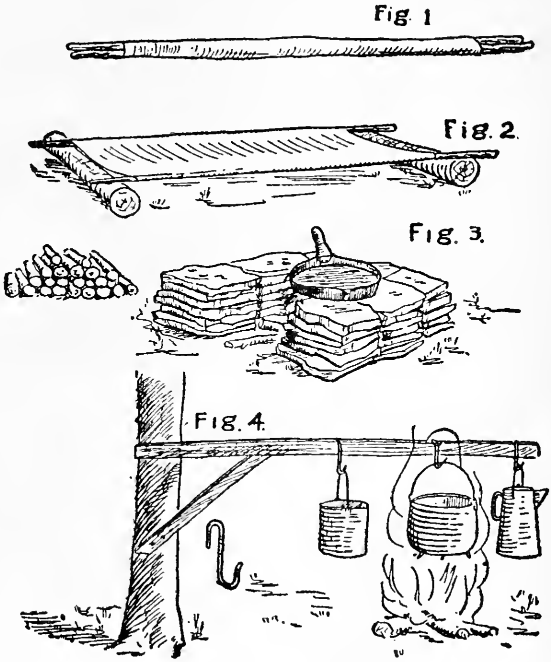
must be far enough away from the fire to be safe from burning. The three poles that form the tripod are lashed together as shown in Fig. 1.

CAMP BED

One of the simplest camp beds is shown in Fig. 1. It consists of a rectangular piece of canvas with a wide hem at each side. Through the opening formed by these hems poles are thrust and their ends are then rested upon two logs as shown. It is a very comfortable bed for camping and the canvas that goes to make it may be used for other purposes in the daytime. This is an ad-

vantage not to be scorned, for the chief aim of the seasoned camper is to get along with as few things as possible or, in other words, to use everything for as many different purposes as possible.

The lower cuts, Fig. 3 and Fig. 4, show two fireplaces. The first is a three-sided wall built of stones. One side is left open to receive the draft, the others are closed to retain the heat. A



CAMP BEDS AND FIREPLACES.

camp fire like this will serve your needs for broiling and frying fish and making coffee quite as well as a costly camp stove.

Figure 4 shows the familiar arrangement of pots and kettles over an open bonfire. This is a more satisfactory method of cooking than the tripod just described under the heading "Camp Kitchen," but it is well to know about both. The first can always be made

in the woods. The arrangement in Fig. 4 requires wire for hooks, boards, etc., which have to be provided ahead of time. It seems that nothing at home ever tasted as good as the stuff one cooks in the open air. It is not always convenient to find an overhanging limb where we want it, but it is possible to find a piece of board and nail it just where it will do the most good, if one would only think of it in time. If you carry a few spikes and a piece of heavy wire to make hooks you will never be at a loss for a place to boil your coffee.

CAMPING CONVENIENCES

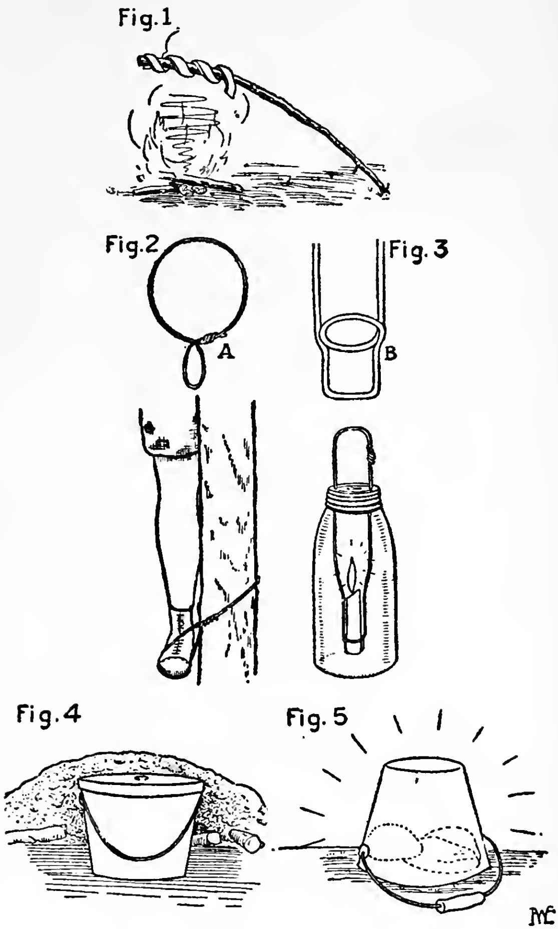
An almost endless variety of ideas could be applied to the yearly camping trip. There are pictured here some things that will cost you absolutely nothing to try and which may prove convenient and serviceable.

Figure 1 shows a method of baking bread. Get a green branch and peel off the bark, making one end pointed. The sharp end is driven six inches into the ground at a point five or six feet away from the fire. Mix up your dough, flatten it out and cut into strips. Twist the strip in a spiral around the end of the peeled stick and hold it as close to the fire as you wish by bending it down.

Figure 2 is a device used for climbing trees. It is simply a piece of strong wire twisted to the shape shown. The foot rests in the small loop or stirrup and the climber encircles the tree with his arms in the usual way. The wire will be easily drawn up, but it sticks going down and provides a foot rest. It is a pioneer device of inestimable value on account of its simplicity. Anyone can climb a tree with one.

Figure 3 is one of the best. It is a lantern made with a fruit jar and a candle. One piece of wire twisted into the proper shape furnishes a candle holder and bail to carry it with. The zinc top of the jar must be punched full of holes to admit air to the candle. Right under the top kinks or twists are put in the wire so that it will not pull through when being carried. In unscrewing the jar top the whole device turns. The candle may be lifted out at will. This home-made lantern is serviceable and trustworthy. It is also safe and easily carried.

Figures 4 and 5 represent the use that may be made of a pail. With a cover on, as in Fig. 4, it becomes an oven. Fill it with

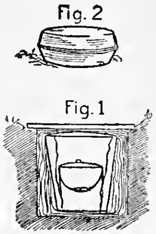


CAMPING CONVENIENCES.

the food you want to bake and cover with coals. The last is a camp warmer. It consists of a pail full of hot stones.

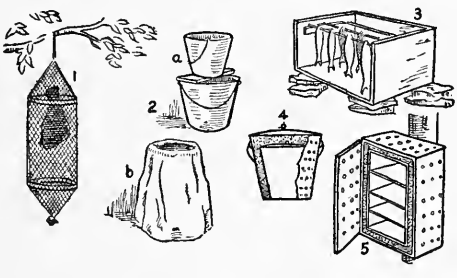
CAMP SUGGESTIONS

Here are a few ideas for the benefit of the inexperienced camper: Figure 1 is a camp fireless cooker. A large water pail is placed in a soap box, and then filled in with paper which has been soaked until it spreads like mortar. The cover of the box must fit tightly and also be covered with two inches of paper on the inside. The idea is to heat whatever you want to bake, roast or boil in a smaller closed pail, and when it is sizzling hot, place it quickly into the big pail and cover it and the box. It will take the heat four or five hours to escape on account of the non-conductivity of the paper, and your food will go on cooking without any danger of being burned. Figure 2 is a roaster made of two pie pans.



COOKING UTENSILS.

Illustration 8 introduces a quartet of suggestions for keeping the food in good condition. Figure 1 is a piece of meat covered with gauze and protected from flying insects by means of netting stretched over small hoops. In high and dry places it will be found very useful. Study a little and you will understand Fig. 2.



CAMP SUGGESTIONS.

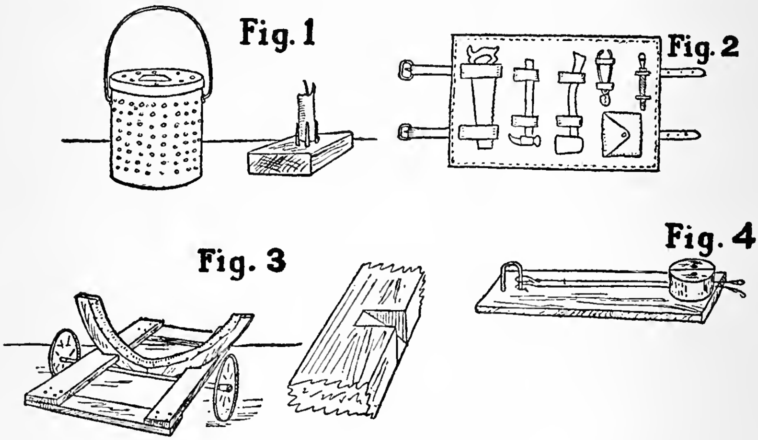
The parts "a" and "b" are just the same, only "b" is covered with cloth. The top ends of the cloth fit into the upper pail of water and thus keep it wet, just as dipping a wick in oil keeps it soaked. The lower pail is full of drinking water and it is kept cool by the evaporation of the moisture in the cloth. Evaporation

absorbs heat. Try it and see. Figures 4 and 5 are other applications of the same idea. The outer pail and box are perforated and the space between each pair is filled with loose porous stuff like a sponge. Keep all where the breeze can strike them. Figure 3 is a fish preserver. It is a watertight box, partly submerged to keep it cool. All the ideas have been tested and found valuable.

CAMP FURNITURE

A LAMP

Figure 1 is a handy pail that may be made by punching holes in a paint can with a sharp nail. It is useful in carrying minnows or small fish. When not being used for this purpose it may serve as a lantern by fastening a candle to a block of wood and placing same in the pail. The idea for this lamp was hit upon one evening while



CAMP FURNITURE.

fishing. The bullheads began to bite just as darkness was falling, and as the party had no lantern the idea of utilizing the pail to shield the candle came to them, and at once it was tried. It worked excellently and a good string of pan fish were carried home before many hours.

A CARRYALL

Cut out an oblong piece of canvas and sew straps of the same material here and there in the manner shown by cut, to hold the saw, axe, and other tools. Leather straps are then riveted to each end and when all the tools are intact the kit may be rolled up and carried very easily. This carryall is useful in a boy's work room or around the home. When you start to do a piece of work hang it up over the bench and all the tools you have will be in plain sight and you will not have to look for them.

A CANOE TRUCK

The little device pictured in Fig. 3 will be useful in carrying a canoe from place to place over land. It consists of a small platform made of pine boards mounted on a pair of wheels. The wheels may be purchased for a few cents at any junk shop. Notches are chiseled out of the center of the long cleats and a piece shaped like the letter U is fitted into them. This U-shaped piece is the part upon which the canoe rests and should be padded with canvas or felt. In ordinary cases canoes are carried on the shoulders in an inverted position and, of course, it is necessary to empty everything out to do so. By the use of this little truck the canoe becomes the holder of all freight and may be pushed along like a go-cart. When not in use the truck is placed in the boat.

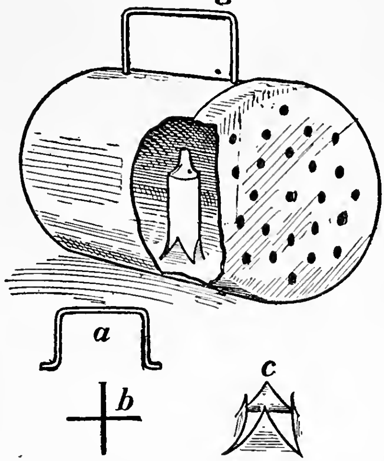
FISHHOOK HOLDER

Fishhooks are a hard thing to carry, especially those with leaders on. The contrivance shown in Fig. 4 will do away with tangles and scratched fingers and safely hold fishhooks enough for the entire party. It is made of a block of wood, a staple and a cork. The block is 6 x 2 x 1 inches and the cork is nailed close to one end of it. On the opposite end a staple to receive the barbed ends of the hooks is driven. The manner in which the device is used is clearly shown by the cut. It has been found very handy on a good many fishing trips and will repay you a hundredfold for the time spent in making it.

ANOTHER CAMP LAMP

This handy camp light or barn lamp is made out of a tin can and a candle. First bend a piece of wire to the shape of "a" and fit it into the can for a handle. As a candle holder, cut, with a chisel, across "b" in the bottom of the can. The points turned up, form the socket. One end of the can is open, and the other is punched

Fig. 1.



A CAMP LAMP.

full of holes. The flame of the candle playing on the top of the can may heat the handle too much. This can be overcome by wrapping with insulated wire or cloth. A wooden hand-hold taken from a pail will also do for the purpose. This light is intended for an emergency, when no other is available. You may find it useful when you least expect to.

CHAPTER II

How to Build a Log Cabin

THE log cabin marks the beginning of American architecture. It was the log house that sheltered the Pilgrims from the weather and Indian attacks, and it was this same style of structure in which Abraham Lincoln and many other of our statesmen were born. In the first cabins the window openings were covered with oiled paper, as there was no glass in the country until some years later, when it was brought over from England.

Although the cabin went out of use as a dwelling very rapidly when saw-mills came into existence, it is still to be found in the timber regions and mountains. Certainly a better forest home could not be wished for.

Boys who enjoy life in the woods and have an opportunity to spend their time among the trees, should build themselves a cabin.

In choosing a site be careful to select an elevated spot. Do not locate your camp at the base of a hill or near marshy and boggy ground. Be sure that good drinking water can be had near at hand.

After selecting a place for your cabin, you must decide upon the style and size to build it. These must be determined largely by the size and amount of timber you can procure. A plan for a cabin simple in design and construction is shown in Fig. 1. This may be altered to suit the builder.

Most of the material for the cabin can be secured in the woods; but for a good roof, floor, and the finishing of the door and window openings, some boards should be taken along. There is no rule for the diameter of the timber to be used, but logs of small diameter are to be preferred for a small cabin. Cut all the logs about two feet longer than the inside dimensions of the building. If the plan here given is followed, the logs should be twelve and fourteen feet long. Leave the bark on the logs.

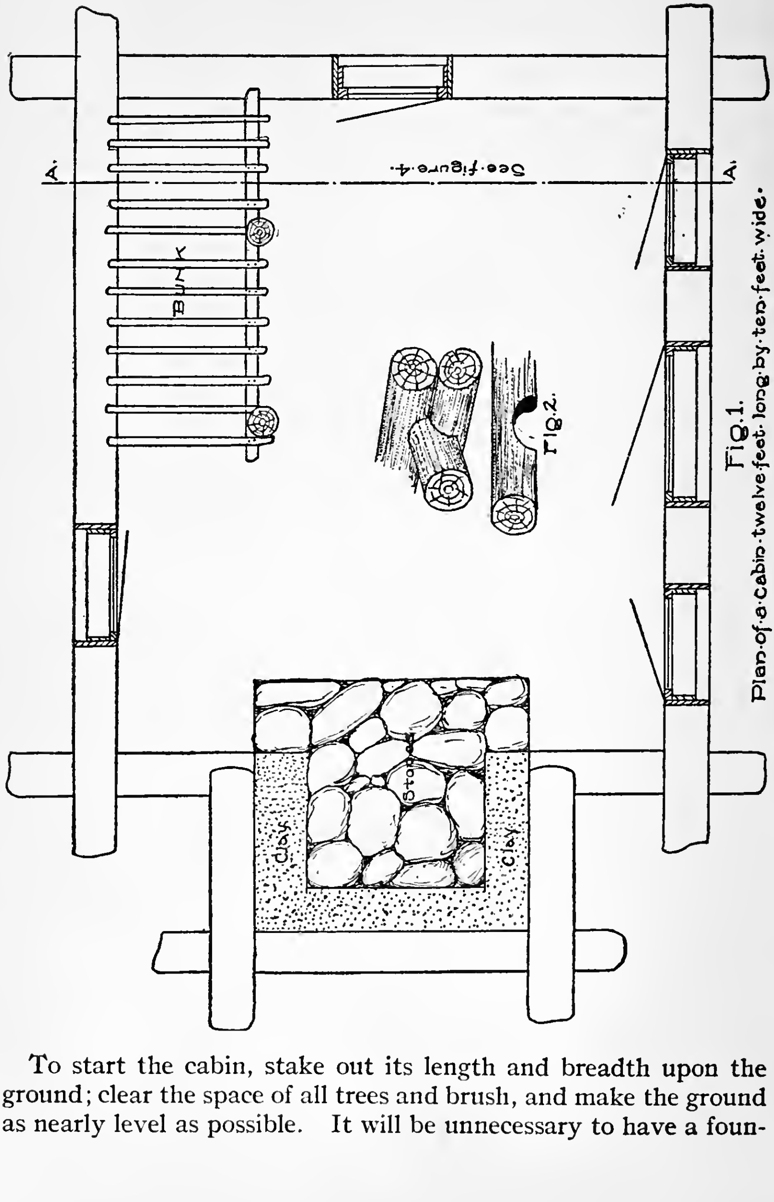


Fig. 1. Plan of a cabin twelve feet long by ten feet wide.

To start the cabin, stake out its length and breadth upon the ground; clear the space of all trees and brush, and make the ground as nearly level as possible. It will be unnecessary to have a foun-

dation for a cabin of this size. Select two fourteen-foot logs for sills and lay them upon the ground, parallel to each other and ten feet apart.

There are several ways of joining the logs together. Probably the most simple scheme is what is known as the lock-joint. As shown in Fig. 2 a notch is cut in the logs one foot from each end. After cutting the notches in two twelve-foot logs, fit them over the sills one foot from the ends.

If you intend to have a wooden floor, you must lay the floor joists at this point. Cut straight poles for these and gain and tenon them into the sills, placing them about two feet apart. (See Fig. 3.)

After fastening the joists in place, continue laying the logs, placing a fourteen-foot log on each side and then a twelve-foot log on each end, until the height of the doors and windows has been reached. This should be about six feet eight inches from the floor. Cut out the openings and finish them with jambs.

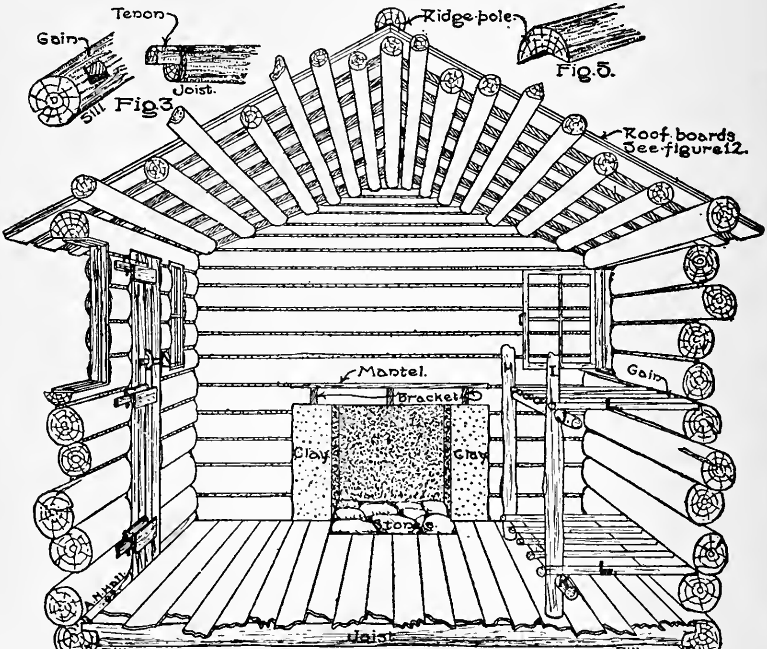
BUILDING THE ROOF

When the desired height of the walls has been attained, you are ready to construct the roof. There are several ways of framing this. Figures 4 and 12 show a simple way. Continue laying the end logs as before, but set each pair of side logs a little farther in than the preceding pair, until they finally meet at the peak of the roof.

The roof may be thatched or covered with bark, shingles, or boards. The thatched roof is the most artistic, and when well made will last from ten to fifteen years; but unless the straw is put on very thickly and woven closely, it is likely to leak. If you intend to use shingles you will require about four quarter-thousand bunches for a roof of this size. Boards will be found the most simple and inexpensive covering. These should be put on as shown in Fig. 12. First nail a layer of boards across the roof, leaving a space of four inches between each board, and then nail boards over the spaces. Fasten a ridgepole at the peak to protect the edges of the boards. This pole may be made out of a small log with a V-shaped piece cut out of it to make it fit over the boards. (See Fig. 5.)

If you cannot obtain glass for the windows, the openings may be covered with paper, or wooden shutters may be made to close the openings at night and during storms.

It is not advisable to build a log chimney and fireplace with the intention of making fires in it. Unless built very carefully and kept in good repair there is always danger of setting the cabin on fire. But whether the fireplace is used or not, it belongs to a log



Section through "A-A", looking toward fire-place. See plan figure 1.

cabin and should be built. Nothing is more artistic than the stick chimney.

First cut an opening about three feet high and five feet wide in the end of the cabin for the fireplace. Then build up the chimney in the same manner as you did the cabin walls, until it extends two feet above the top of the fireplace. Use large logs for this portion of the chimney and fit the ends against the logs of the main structure.

When this has been done, make a stone hearth, filling in the stones with clay, and packing them down until they are level with the floor joists. Make the clay linings of the sides of the fireplace from ten to twelve inches thick, beating the clay until it becomes hard. Smaller sticks may be used for the upper part of the chimney. Lay these up in clay mortar and line the inside with clay as the work proceeds. Figures 1 and 4 show the details of the fireplace. Fasten a shelf above the fireplace on wooden brackets as shown in Fig. 4.

When the carpenter work of the cabin has been completed, caulk all the spaces between the logs with clay and moss. In doing this use a pointed stick.

THE INTERIOR FINISH

The exterior of the cabin being completed, we will turn our attention to the finishing of the interior. The cost of the structure will be considerably reduced if, instead of making a wooden floor, you dry out the ground and pack it down until it is hard. If you are situated where you can procure boards, nail them to the joists which you set in place during the early part of the building's construction.

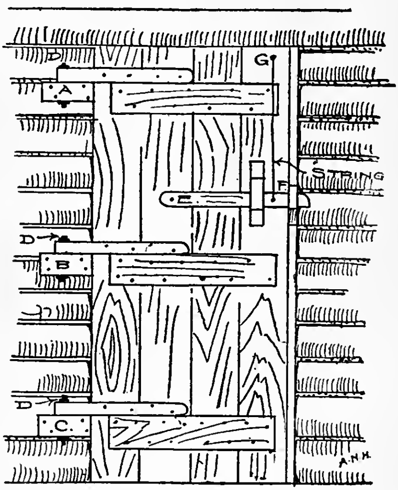
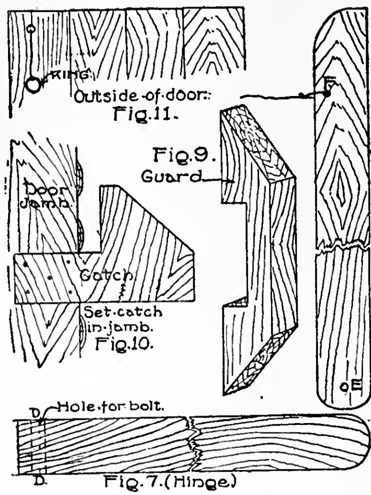


Fig. 6. CABIN DOOR

Make the cabin door of matched boards, fastening them together by means of battens at top, center, and bottom. If you do not happen to have iron hinges, there are several ways of making good wooden ones. Cut three blocks of wood and nail them to the inside edge of the door jamb as shown by A, B, and C in Fig. 6. Make three wooden hinges, similar to Fig. 7, each about eighteen

inches long. Round one end of each, and bore a small hole through it at D. Nail these three hinges to the door in such a position that, when the door is put in place, the ends of the hinges will rest on the blocks A, B, C. Now, when you know where the holes bored in the hinges come on the blocks, bore a hole through each block directly below that in the hinge. When ready to put the door on, set it in place and either bolt the hinges to the blocks or slip large spikes through the holes.



DETAILS OF DOOR.

A hinge very commonly used consists of a pole about four inches longer than the door. This pole is nailed to the edge of the door, one end extending into a hole bored in the floor, and the other end into a corresponding hole in the log over the door opening.

The old-fashioned wooden latch and latchstring is a very good and serviceable fastening for a cabin door. The latch should be about two feet long and two inches wide (Fig. 8). Make a guard similar to that in Fig. 9, cutting a slot in it about three and one-half inches long and a little deeper than the latch is thick. The catch should be made like Fig. 10, with an incline, so that the latch will slide easily into the slot.

After screwing the latch to the door at E (Fig. 6), fasten the guard and catch in place. The catch should be set into a slot cut in the door jamb as shown in Fig. 10. Bore a hole through the latch at F and another through the door at G (see Figs. 6 and 8); after which fasten a cord to the latch at F and pass it through the hole made in the door. Tie an iron ring or small weight to the end of the string hanging outside of the door. Figures 6 and 11 show the latchstring. The latch, guard, and catch may need some adjusting at first to make them work perfectly.

Two bunks should be arranged in a corner of the cabin as shown in Fig. 4. Erect two posts thirty inches from the wall (see H and I in Fig. 4), and fasten two cross-pieces, J and K, to them—K about twelve inches from the floor. Cut some straight poles about three feet long, and gain one end of each into the wall, and fasten the other ends to the crosspieces J and K. Place these poles about six inches apart (see L in Fig. 4), and cover them with a thick layer of straw.

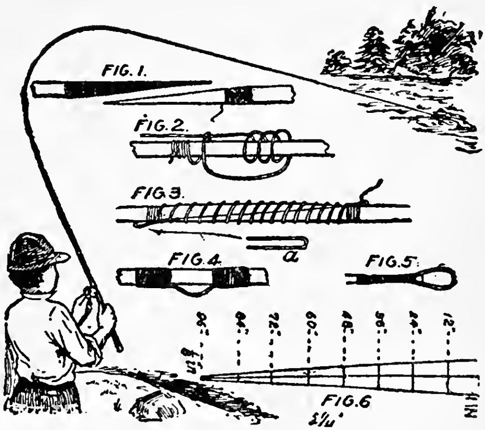
In addition to a few stools, which can be made out of boxes, you should have a corner cabinet for guns, fishing tackle, camera, photograph supplies, etc. This may be made out of one of the packing cases in which you brought your camping outfit. Attach the cover to the front with leather hinges and fasten a few shelves inside.

CHAPTER III

The Boy Fisherman

A FISHING ROD

HERE is the way to make a good serviceable fish pole. Get four pieces of hickory or any hard wood and trim them nicely to even length, say two feet. Each of the sections is now given a uniform taper, with jack knife and sandpaper. The diagram, Fig. 6, shows the proper scale to follow in shaving off the wood.



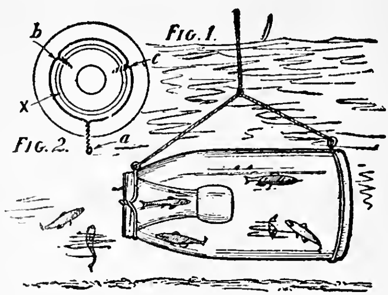
A FISHING ROD.

In its eight feet of length the pole tapers from one inch in diameter to one-eighth inch. The figures in the diagram represent the amount you would cut off provided the pole measured feet instead of inches. The joints are fastened together in quite a new way. Cut them to a sharp point as shown in Fig. 1, and wrap fine silk thread to each of the points. Now dip them in

thin glue, press firmly together and wrap outside of both with heavy cord. Any good grade of fish line will do, silk preferred. Figures 2 and 3 explain this outside wrapping. The guides for the line to run through are shown in Figs. 4 and 5. Figure 5 is the end of the pole. It is a wire loop lashed tightly to the pole. Figure 4 is a piece of wire put in at each joint and held there by the same wrapping that holds the joints together. The outside of the pole should be smoothed with fine sandpaper and then rubbed with oil. Though the cost of the pole is next to nothing you will find it tough and reliable.

A MINNOW TRAP

The minnow trap shown here will be found very serviceable during the fishing season. It is made of a quart fruit jar and the neck of a bottle. The latter must be broken off evenly at a point where its diameter is just big enough to fit tightly in the jar top. The bottle may be broken evenly by filing a mark all around and then wrapping a fine wire around the scored point. The ends of the wire extending some distance from the bottle are heated in a gas flame or by a candle, and as steel is a good conductor of heat the wire around the glass will soon get quite hot. When its temperature increases to a point that prevents your touching it, plunge the whole thing into a vessel of cold water and the break will come just at the right place.



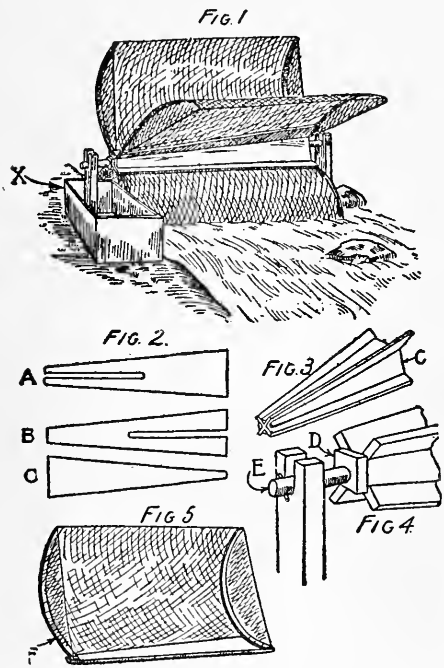
A MINNOW TRAP.

A variation of this plan is to wrap the bottle with oil-soaked yarn and set the latter on fire, then when it has burned off and heated the glass dip it into the water. The zinc jar top is cut away until only the rim or threaded part remains. If the neck of the bottle does not fit snugly, pack it with rubber or cloth. The picture shows clearly how it is arranged when finished. A turn of wire at each

end, with an eye twisted at the top, is used to suspend the trap. Locate a shallow place frequented by the minnows, and hang it in their midst. After a while they will begin to swim confidently into the funnel and only a small percentage will be able to get out. This plan has been tried and tested many times and it gives satisfaction.

A FISH WHEEL

Here is an ingenious minnow trap in the form of a fish wheel that will get them if there is any to get. In a word, it is a wheel made of wire screen and turned by the current. The minnow that comes near it will be scooped up and will fall into the trough in the center and thence into the box at the side. In the northwest, where the salmon come from, there is one with paddles thirty feet wide and probably three times as long. The current of the Columbia River, where it is used, is sufficeintly swift to turn it, and to aid in this there is a large flat wooden board at the edge of the wire paddle. The gigantic wheel is submerged partly and literally scoops up the salmon by the ton when they are running good. Now our trap wheel is to be a counterpart of this monster device and will work on the same identical principle. Whether or not it scoops up minnows and other fish depends on the kind of stream you place it in. If it



A FISH WHEEL.

abounds with finny life and has a strong enough current you may depend upon its success.

To make the central part we first cut out two wedge-shaped pieces of one-inch board and split them halfway, as shown in A and B, Fig. 2. This work can all be done with a saw. First mark out a diagram of the whole thing and then saw on the lines. When finished the two parts are fitted together and nailed. We then fill in with four wedges having no slit, C, in Fig. 2. The hub when finished will have the appearance of Fig. 3. Each of the four troughs should have an incline of two inches. This is important, as it is intended to precipitate the minnows into the box. You can now nail curved pieces of wood, preferably heavy hoops, to the hub and stretch your wire netting over same. This is plainly shown in Fig. 5. If you use common fly screen I think the water will turn the paddles, but if there is not enough current to do so, add some solid substance at the end that the water cannot pass through. It need not turn rapidly, one or two complete revolutions in a minute will be plenty. You can experiment with it and will soon be able to rig it up so it will go at about that speed.

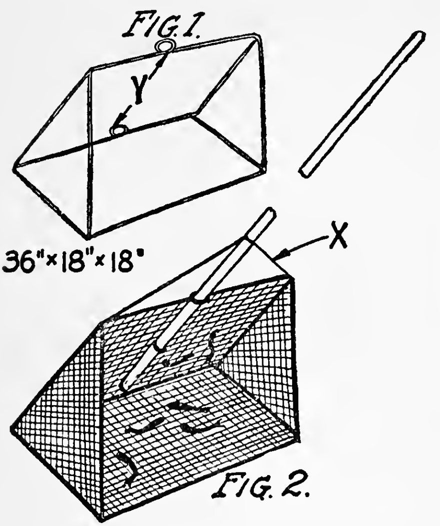
The bearing or support of the axle consists of two posts driven into a shallow place or a narrow neck of water that has considerable fall. In a small creek or ditch you can easily construct such a strait by filling in. For an axle use iron pipe or a couple of heavy bolts. The bearing posts should be of hard wood. Bore one-inch holes a little down from the top of each and saw out the intervening piece. Make the resting place of the axle very smooth and smear it liberally with lard or wagon grease. Make the top of the posts level by using a carpenter's level on them. If one is even slightly higher than the other the wheel will not turn freely. You must do your work accurately and carefully here—just as any place else—if you expect to get results.

A MINNOW NET

Perhaps you do not want to trap your minnows, but do want some device you can carry with you to catch the little fellows whenever you want them. You can have your fish traps close to home where you can watch them; but if you are away in the

woods for a day you will need some way of replenishing your supply of bait, or of getting bait if you have none at all.

The scoop net shown herewith may be made from a piece of fly screen and a length of heavy wire. The first thing to do is to bend the wire to the shape shown in Fig. 1. The best way to do this is to determine what size you are going to make the frame and drive four spikes into a plank about half-way. The spikes should be spaced just as you wish the finished frame, say 36 x 18 inches. A good way to straighten the kinky wire is to draw it through a small hole or between two rows of nails which are one-eighth inch apart. Now bend it around your four spikes to form the rectangle needed for the bottom, then once more for the back, and a larger one for the front. With the aid of the diagram you can easily get the desired shape. A pair of pliers will be needed to make the two rings in the rear and to make a twist joint where the wire runs out. Cover the frame with wire cloth. The fastening is done by ripping strands of fine wire from the screen and using it as thread to sew the rest in place. A broomstick will do for the handle. Stick it in and tighten the rings with your pliers.

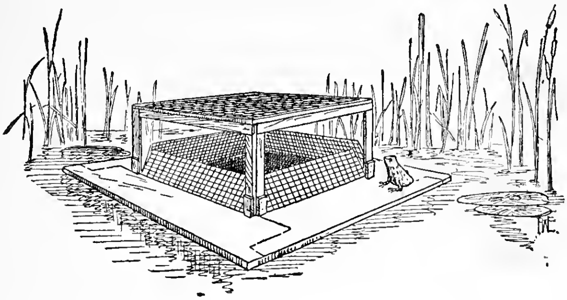


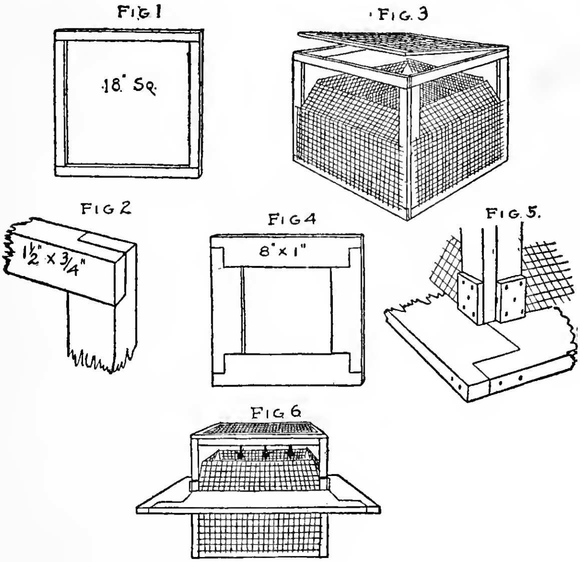
A MINNOW NET.

The net is used by dragging it through the water and lifting it up suddenly at the right moment. It will take you a couple of hours to make it neat and strong, but apart from the expenditure of time its cost is practically nothing. If your town is near fishing waters or near a summer resort you can do a thriving business selling minnows to visitors. Between traps and net you should be able to keep constantly a good supply on hand.

A FROG TRAP

Frogs are splendid bait. Many fishermen prefer them to minnows if they are after bass or pickerel. Then, too, the frogs are





A FROG TRAP.

desirable for themselves. What better camp dinner or home dinner, for that matter, can be imagined than a tender, well-cooked

mess of frogs' legs? The old-fashioned way to get your frog is to come up behind the prey and deal it a heavy blow with a club. It is effective, too, if the hunter has skill. Another way is to spear him with a pike pole. In the South they fish with a piece of red cloth for bait and get large numbers of frogs. Then, again, some prefer to shoot them with a rifle. But the best, most humane, and most satisfactory way to capture the frog is by means of a trap. Here is one which has proven an excellent success.

The beginning of our work will be on the square frame pictured in Fig. 4. The size is marked 8″ x 1″, but you may with advantage use a heavier board, as it will sustain more weight without sinking below the surface of the water. Next comes the framework that rests upon this heavy enclosure. This frame is constructed of $1\frac{1}{2}''$ x $\frac{3}{4}''$ strips. They may be nailed right into the frame (Fig. 4) and then reinforced by the corner blocks shown in Fig. 5. The netting used should be coarse fly screen of about one-quarter inch mesh. It is fastened with small staples sold for the purpose at hardware stores. The upper portion of the enclosure is left uncovered with wire, the latter being bent to the inside, as shown by the drawings. We will now make a cover or lid for our trap. It consists of a simple frame (Fig. 1) covered by the wire cloth. It is hinged on and should be provided with a catch or hasp to keep it in place.

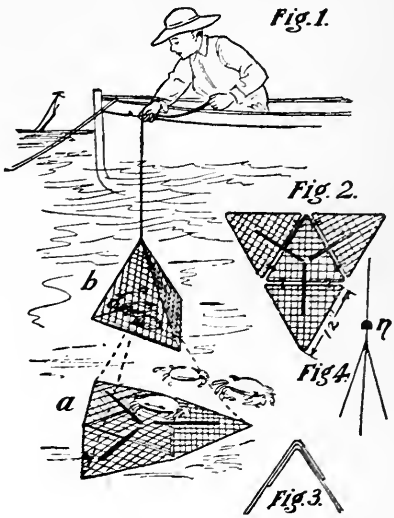
To use the trap set it out in the water and tie it to a stake so it cannot float away. The lower half will be submerged, as shown in the top sketch. Bait of some kind, such as minnows or flies or grass-hoppers or bits of red flannel, hangs from the lid near the edge, so that the frog will have to jump after it. If he does so, he will, of course, land on the inside and will be unable to climb out. It may be possible that this trap will catch more than frogs, but that will only add to the fun when you come to pull it ashore.

THE CRAB TRAP

Crabs are, in some localities, the only bait the large game fish will go after, and at such places become indispensable. No matter where you are fishing, if crabs are to be had, they are good bait for

bass of all kinds. The net shown in the accompanying cuts is easily constructed of scrap material. First twist a piece of wire into the shape of a triangle, each side of which measures twelve inches. Instead of twisting the ends together, arrange them as shown in Fig. 3. A fine piece of wire, taken from an old broom and annealed, may be wrapped around the double strands. Make four triangles of the same size and cover them with coarse mesh screen. The screen can be sewed to the frame by using a raveling for a thread. Lay the completed sides on the floor in the position indicated by Fig. 2.

Each of the three outer triangles are hinged to the central one by means of two small wire loops. Next put in three corset steels, weaving them in and out of the screen. Their purpose is to hold the trap open flat as in Fig. 2. Now tie a stout fish line to each of the outer corners of Fig. 2. About two feet from the frame bring the three cords together and tie them to the main string. Figure 4 illustrates this pretty clearly. "N" is a large heavy nut threaded onto the line. As it drops down it will draw the three strands together and cause the wide open trap to close on its prey. A good way to straighten wire is to draw it between two rows of spikes which have been driven close together.



A CRAB TRAP.

The trap is used as follows: Drop it to the bottom of the stream from a boat or dock, and the steels will cause it to open flat. In clear water you can see the crabs crawl after whatever bait you are using; if not, at given intervals drop the heavy nut and haul to the surface. It is very effective and can be easily carried.

A FISH STRINGER

Here is a stringer that will do good work on your camping trip. Get a piece of wire which has been taken from a bale of hay and twist a handhold on one end, as in Fig. 2. The other end is sharpened and must be concealed in a cork or bit of wood to avoid prodding the hands. The wire of the size mentioned is intended for small pan fish. If you are out for larger fish, use heavier wire. The bending is rather hard to do unless the wire is annealed. This means softened or made more pliable. It is accomplished by heating the wire to a cherry red and then cooling as slowly as possible, by turning the fire down a little at a time. As may be

Fig. 1. Fig. 3. Fig. 2.

A FISH STRINGER.

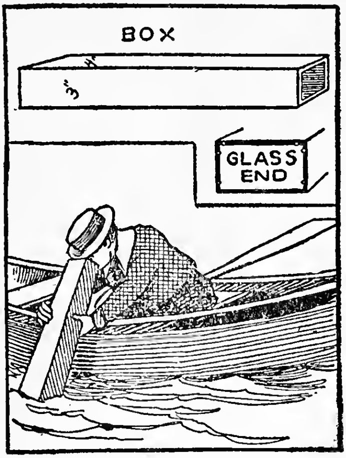
readily seen, the stringer is also used to carry the catch home. If you make one of them it will not take more than a few minutes and it will prove itself a worthy addition to your camp kit.

A MARINE TELESCOPE

A marine telescope probably will never catch a fish for you, but it may be very useful on a fishing trip. With it you can locate sunken stumps, submarine weed-beds, and fish-beds themselves. But that is not the best use for it. You can study submarine life, can find no end of pleasure sitting quietly on your boat and watching what goes on in the water beneath you.

The materials required for a submarine telescope are very simple, consisting of a few feet of thin board, a small oblong piece of glass, some wire nails, and a piece of sealing wax. The glass may be three by four inches or larger.

Saw from quarter-inch boards four pieces of the same length, twenty inches, two each of widths to correspond with dimensions of the glass. Nail these together into the box shown open at both ends. Lay the piece of glass over one end and fasten securely in place with pins driven into the wood and twisted over. Large headed tacks may be used instead, if desired, the tacks being driven



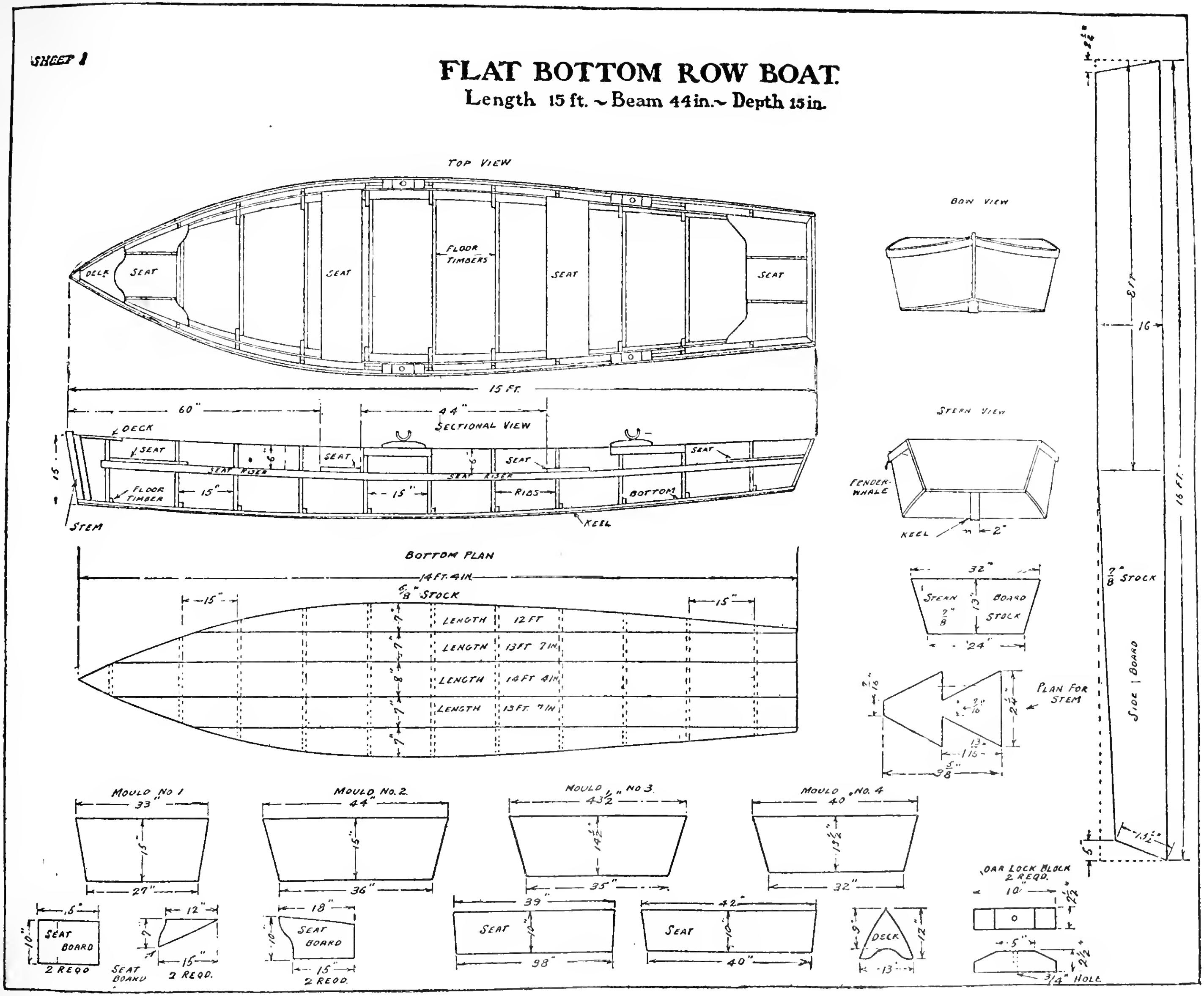
A MARINE TELESCOPE.

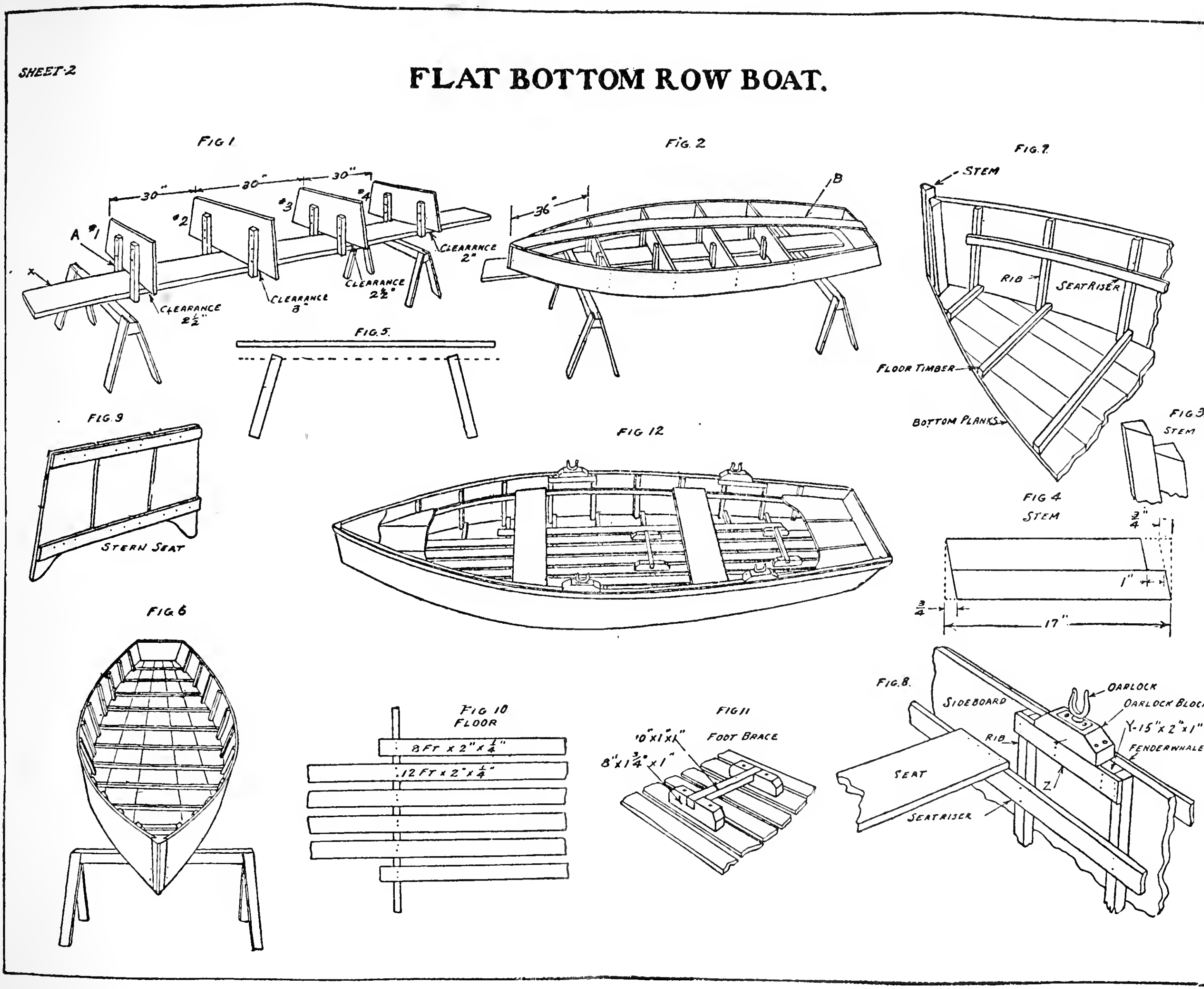
in the wood and their heads overlapping the glass edges, thus holding the glass in place. Then make the glass end watertight by closing up all seams with the sealing wax.

When in use the glass end is placed in the water while you look down through the open end. The light is thus shut out from all parts except that which must come through the glass end, an inch or two under water. The water telescope is long enough for you to sit comfortably in the boat and still watch the world under water at the same time.

FLAT BOTTOM ROW BOAT.

Length 15 ft. ~ Beam 44 in. ~ Depth 15 in.




SHEET-2
FLAT BOTTOM ROW BOAT.
FIG 1
30"
30"
30"
A
#1
#2
#3
#4
CLEARANCE 2½"
CLEARANCE 3"
CLEARANCE 2½"
CLEARANCE 2"
FIG. 2
36"
B
FIG. 7
STEM
RIB
SEAT RISER
FLOOR TIMBER
BOTTOM PLANKS
FIG. 5
FIG. 9
STERN SEAT
FIG 12
FIG 3
STEM
FIG 4
STEM
¾"
1"
¾
17"
FIG 6
FIG 10
FLOOR
8 FT x 2" x ¼"
12 FT x 2" x ¼"
FIG 11
FOOT BRACE
10" x 1" x 1"
8" x 1¾" x 1"
FIG. 8
SIDEBOARD
OARLOCK
OARLOCK BLOCK
Y-15" x 2" x 1"
FENDERWHALE
RIB
SEAT
SEAT RISER
Z

PART II

THE AQUATIC BOY

CHAPTER I

A Flat Bottom Row Boat

HERE is a very simple and serviceable boat, designed for boys. Before beginning actual work see that all your tools are in good condition. Next look over the drawings reproduced herewith, and get a clear idea of how you are going to do each step of the job. Sheet 1 is a plan that shows every little detail and dimension, and the lad of sixteen or more will really not require any more assistance than is furnished by this print. Sheet 2 is a supplementary drawing, that gives pictures, not plans, of each important stage of the construction.

You should have the two drawings close at hand as you proceed so that you can refer to them instantly. First saw out the molds, No. 1, No. 2, No. 3, and No. 4, on Sheet 1. The exact size is shown. Nail them to a plank as shown in Fig. 1 (Sheet 2). They should not rest on the plank, but should have the amount of space between as is indicated by the clearance notes printed under each one. We now tack the sideboards or side streaks on to the molds and bring them to a point at the bow or fore end. Put in the stern board and the middle bottom board. This is shown in Fig. 2 (Sheet 2). The molds are merely to aid us in shaping the boat, and nothing must be nailed to them except temporarily. Figure 5 shows how the sideboards will have to be shaved off with a plane so the bottom boards will lay flat upon them. The stem of the boat is marked Fig. 3. Its dimensions are shown clearly. Use great care in cutting it out. Figure 7 shows how the sideboards fit into this stem piece. The boat now begins to look like the real thing. We have the sides, stern, stem, and bottom complete.

We next put in the ribs and floor timber. Figures 7 and 6 on Sheet 2 show this clearly. The seat riser is a long cleat nailed to the ribs. The floor, as in Fig. 10, consists of long cleats nailed to the floor timber. We now put on the seats and the little decking at the bow end of the boat. Next come the blocks for the oarlocks, shown very clearly in Fig. 8 (Sheet 2). Along the whole length of the boat at the top of the sideboards and stern is a strip called the fenderwale. It is shown in the drawing marked "stern view" on Sheet 1. The keel is also shown. The keel is a hard board nailed to the bottom of the bottom of the boat. It protects it when sliding on the sand of a creek bed or in shallow water.

BILL OF MATERIAL

Sides.—Two boards 16′ long, 16″ wide, and $\frac{7}{8}$″ thick.
Bottom.—One piece, length 14′ 4″, width 8″, thickness $\frac{5}{8}$″.
Two pieces, length 13′ 8″, width 7″, thickness $\frac{5}{8}$″.
Two pieces, length 12′, width 7″, thickness $\frac{5}{8}$″.
Thickness of all bottom boards is the same.
Molds.—(No. 1) one piece, length 33″, width 15″, thickness $\frac{7}{8}$″.
(No. 2) one piece, length 44″, width 15″, thickness $\frac{7}{8}$″.
(No. 3) one piece, length 43.5″, width 14.5″, thickness $\frac{7}{8}$″.
(No. 4) one piece, length 40″, width 13.5″, thickness $\frac{7}{8}$″.
Thickness of all molds is the same.
Stern Board.—One piece, length 32″, width 13″, thickness $\frac{7}{8}$″.
Seats.—Two pieces, 15″ x 10″ x $\frac{5}{8}$″.
Two pieces, 12″ x 7″.
Two pieces, 18″ x 10″.
One piece, 39″ x 10″.
One piece, 42″ x 10″.
All seats are the same thickness.
Deck.—One piece, 13″ x 12″ x $\frac{7}{8}$″.
Stem.—One piece, 17″ long x $3\frac{5}{8}$″ x $2\frac{1}{4}$″.
Oarlock Blocks.—Four pieces, 10″ x 2.5″ x 2.5″.
Ribs and Floor Timbers.—42 feet of 1″ square oak strips.
Seat Risers.—Two strips, 14′ long x 2″ wide x $\frac{7}{8}$″ thick.
Floor Strips.—Two pieces, 8′ long x 2″ wide x $\frac{1}{4}$″ or $\frac{1}{2}$″ thick.
Two pieces, 8′ long x 2″ wide x $\frac{1}{4}$″ or $\frac{1}{2}$″ thick.
Four pieces, 12′ long x 2″ wide x $\frac{1}{4}$″ or $\frac{1}{2}$″ thick.

Foot Braces.—Four pieces, 8″ long x $1\frac{3}{4}$″ wide x 1″.
Two pieces, 10″ long x 1″ x 1″. All of oak.

Oarlock Block Supports.—Four pieces, 15″ x 2″ x 1″. Y (Fig. 8).
Four pieces, 17″ x 2″ x $\frac{5}{8}$″. Z (Fig. 8).

Fenderwale.—Two long strips, 16′ long x 2″ wide x $\frac{1}{2}$″ thick.

Keel.—Oak board, 1″ thick, 4″ wide, and 15′ long.

Use 2-inch clout nails for nailing bottom. Brass screws in all sizes from 1 inch long to 3 inches long will be required. Get 10 cents' worth of each size and fill out with more if the work demands. The boat should receive two coats of paint inside and three coats outside. This will take two gallons of paint and one gallon of boiled oil for thinning purposes. Oarlocks cost 25 cents a pair, two pairs are required. Caulk all cracks in the bottom with oakum.

The mark (′) means feet; the mark (″) means inches; 2.5″ means two and a half inches.

Work very slowly and carefully. Three weeks is good time in which to make this boat right.

CHAPTER II

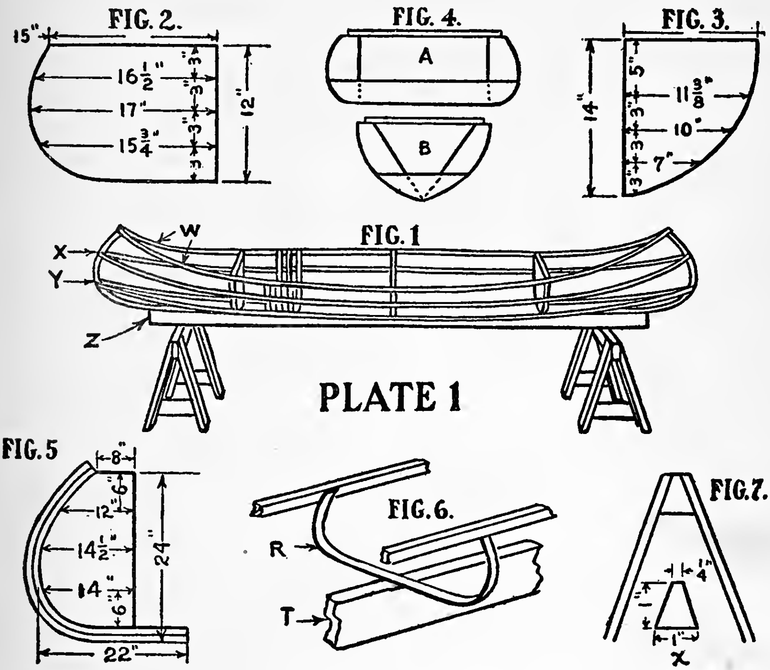
A Canoe

One of the most interesting boats to build, and one of the safest and most serviceable when properly handled is the canoe. To construct a strong, safe canoe is not difficult if adequate directions are followed. It is the purpose of this chapter to tell you in detail how to work and what materials to buy. It is written for the average boy who has only a hammer and saw and plane to work with and but a few dollars to spend on pleasure craft.

It will occur to you at once that the hardest part of boat construction is the shaping. Anyone could build a long box, but how are we going to accomplish the graceful curving of the sides and the neat tapering of the ends? We must build forms or molds for this purpose, and the strips to be bent must be pliable and softened by immersion in boiling water or steam for hours.

The very first thing to do is to set up a heavy plank on two strong trestles. It is marked "Z" in Fig. 1, Plate 1. Mark the center and a line four feet each side of the center. Then make one mold or form like "A" and two like "B." Figure 2 shows exact dimensions for one-half of mold "A," Fig. 3 is one-half of "B." When you have the molds completed, set the big one "A" on the center line of the plank and nail it securely; the two smaller ones "B" are fastened to the four-foot lines you have drawn. We now fasten to each end of the plank the curved piece shown by Fig. 5. The exact curvature of this 50-inch oak or ash strip is indicated by the figures. It is shaped by being softened and bound to a form as shown for several days. The first two long strips or gunwales "W" are screwed to the stem and stern pieces and to the molds. Next temporarily fasten the pair "X" and the pair "Y." The work so far described is by far the most difficult to do. When complete the skeleton of the canoe will look like Fig. 1 in Plate 1. The joint and shape at the ends of those long strips is shown by Fig. 7.

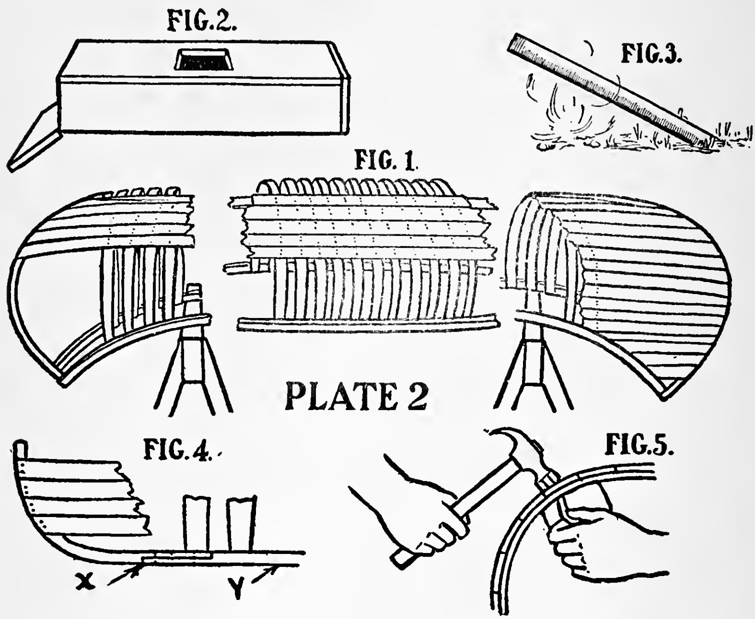
The putting in of the ribs is our next concern. They should be green elm, hickory, or ash, three-eighths inch thick and one and one-half inches wide, and long enough to make the curve from gunwale to gunwale. The center or longest one is the first to be put in, as "R" in Fig. 6 shows. It goes outside of "X" and "Y" and inside the gunwales "W." The ribs are placed one inch apart



CANOE PLAN.

and are fastened with galvanized nails. The boiling or softening of the ribs may be done by making a steamtight box as in Fig. 2, Plate 2. The opening in the top is set over a vessel of boiling water and the ribs are placed in through the open end. In this way one burner on a gas stove may be made to keep the box full of steam. After a night's immersion in the hot vapor the ribs can be bent without fear of breaking or cracking. When the ribs

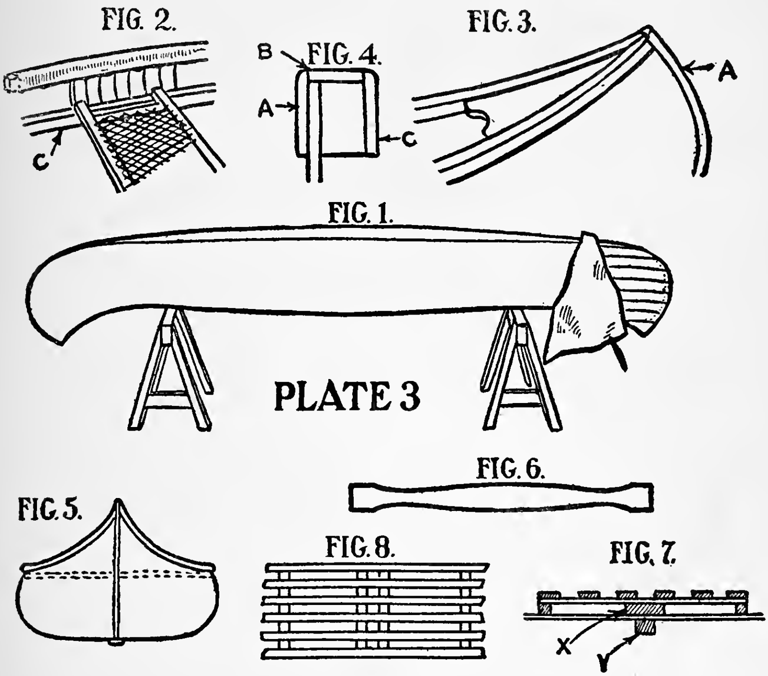
are well set after being in place two days, remove "X" and "Y." Figure 3 is an iron pipe four inches in diameter, with one closed end driven into the ground at the angle indicated. It is filled with water and a bonfire built under it. Strips may be placed inside the pipe, and by maintaining a hot fire you have a fairly satisfactory apparatus for steaming the ribs.



CANOE PLAN.

We now remove the plank and substitute a strip two inches wide and one inch thick, and long enough to run along the bottom of the canoe, being fastened to the curved stem and stern piece. The framework of the canoe being completed, we proceed to cover it either with canvas or planking or both. The planking process is shown by Fig. 1 in Plate 2. The material used is cypress, three inches wide and one-quarter inch thick. It is shaped like the siding or clap boards used on houses and one board overlaps the other. Begin at the center and work to the sides. Clout nails are used.

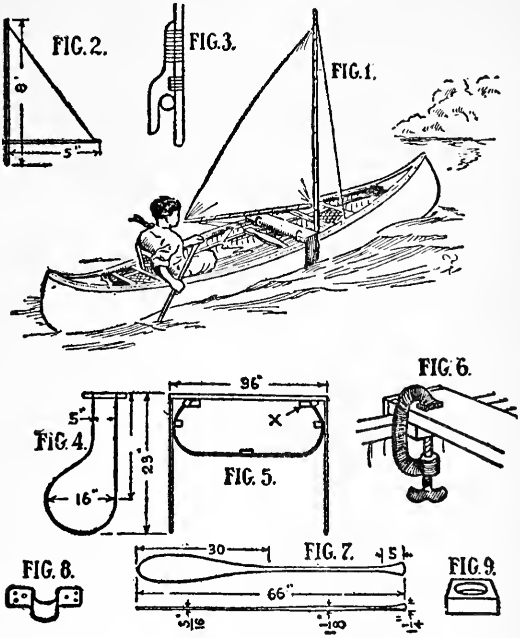
They are clinched on the inner side as shown in Fig. 5. The joint used in fastening the long bottom piece to the stem and stern is shown in Fig. 4. If you wish to use canvas as a covering, observe Fig. 1 on Plate 3. The canvas should be extra heavy and may be used without the planking; that is, it may be nailed directly on the skeleton, as it appears in Fig. 1, Plate 2. Lay your wide



CANOE PLAN.

strip of canvas on the framework and tack the center line to the center line of the canoe bottom strip. Use copper or galvanized tacks. Stretch it as you go, leaving no wrinkles or fulness. At the ends it will have to be cut with a shears and lapped over two inches, the surplus being snipped off and thrown away. A coating of glue may be put on the canvas to shrink it and fill up the meshes, but it is of no use unless it is afterward covered with

three good coats of paint, inside and outside. The deck shown by Fig. 3, Plate 3, is now put in and a thin strip of molding nailed along the edge of the canvas to the gunwales, also an outer stem and stern strip "A." A long two-inch board or keel is nailed to the bottom outside the canvas to prevent injury to same when the boat scrapes the bottom. Figure 8 shows the floor; Fig. 7 is a sectional view of the same. A picture of the seat is marked Fig.



CANOE PLAN.

2; "C" is one of the inside strips to supportsame. Figure 6 is a brace used in the center of the boat. Notice it under the sail in the complete sketch. The boat is now entirely finished. It may be varnished on the inside to look like light oak.

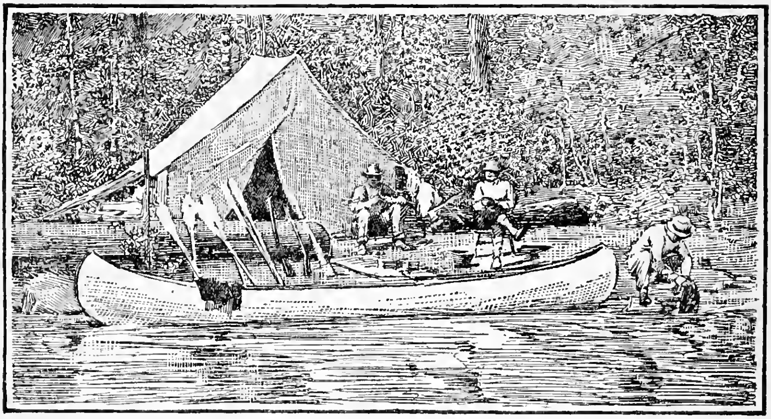
Illustration 26 shows plans for a sail and paddle. The dimensions of the latter are given. To keep the water from running down to the hands a rubber washer or wrapping of cord may be

used. Figure 4 shows size and shape of leeboards, which extend down over the sides of the boat into the water. Figure 5 is a view of same. Figure 6 shows how the leeboard device is clamped to the boat at the point "X." The whole thing, including sail, may be lifted off or added to any canoe. Figure 2 is the sail plan, Fig. 3 a home-made cleat for swinging it. The base of the mast rests in the block (Fig. 9) and passes through the strap (Fig. 8), which is made from a heavy tub hoop. This about finishes the canoe equipment. If you follow instructions you will have a good, serviceable boat. An estimate of the cost is less than $10.

Base (Temporary).—One piece, 14′ x 4″ x 2″ pine.
Stem Pieces.—Four pieces, 34″ x $1\frac{3}{4}$″ x 1″ oak.
Gunwales.—Two pieces, 16′ x 1″ x 1″ oak.
Side Strips (Temporary).—Four pieces, 16′ x 1″ x 1″ oak.
Ribs.—190′, 2″ x $\frac{3}{4}$″ ash, elm, hickory, or cypress.
Planking.—275′, 2″ x $\frac{1}{4}$″ x $\frac{3}{16}$″ cypress.
Keel.—One piece, 14′ x 3″ x $\frac{1}{2}$″ oak.
Seat Raisers.—Two pieces, 14′ x 1″ x 1″ oak.
Seats.—Ten feet, $1\frac{1}{2}$″ x $1\frac{1}{2}$″ oak.
Thwart.—One piece, 31″ x 3″ x $\frac{3}{8}$″ oak.
Fenderwale.—Six pieces, 16′ x $1\frac{1}{8}$″ x $1\frac{1}{4}$″ cypress.
Deck.—Two pieces, 12″ x 6″ x $\frac{1}{2}$″ cypress.
Canvas.—28″ wide by 18′ long.
Paddle, Sail, and Leeboards.—Dimensions given on cuts.
Paint.—Two gallons.

CHAPTER III

How to Manage a Canoe



A CANOE, like an unbroken colt, is of little value to its owner until it has been mastered. As a preliminary, the young canoeman should learn to swim before he attempts to occupy and guide his frail and uncertain little craft. Then, when he is thoroughly at home in the water, and not before, he may venture forth with his canoe.

Again, like the unbroken colt, the canoe has a deplorable habit of ridding itself of its burden. The canoeist must forestall this by giving much attention to balance. The load should be evenly distributed, so that the canoe will ride the water on an even keel. When properly loaded, it is remarkable what a weight such a small craft will carry. The heaviest part of the load should be stowed in about the middle of the canoe, and a few of the lighter things placed halfway between that point and the bow. Then, when the paddler is seated in the stern, the canoe should float on a level keel. If it lists to either side, go ashore at once and rearrange the

load. Do this as often as necessary, it will be time well spent and may save a disastrous upset before the journey is done.

The weight to be carried with safety will vary under different conditions of wind and water, and will depend, too, on the size and style of the individual canoe. Never load so heavy that you have not sufficient freeboard to weather a stretch of rough water or a sudden blow. An eighteen-foot cruising canoe of about thirty-three inches beam will carry from five to seven hundred pounds with safety; any addition to the latter weight will, of course, depend entirely on the skill displayed in loading and the expertness of the paddler. Remember that a light canoe is dangerous and an overloaded one is fatal.

There are two general types of canvas canoes. We will eliminate those "tenderfoot" crafts of highly polished wood which are fit only for mill ponds, satin cushions, double-end paddles, and "fair-weather" canoemen. The canoe of the real woodsman is the canvas-covered craft in general use on wilderness lakes and rivers. In the far north they still use a few primitive birch-barks, but the white man has found them inferior, for hard usage, to the more modern canvas-covered canoes. The two types referred to are similar in shape, but of different widths. The narrower one is more speedy and a bit more unsteady; while the wider type is somewhat slower in its progress, but a safer load carrier and therefore better for cruising. An eighteen-foot canoe of thirty-three inches beam is a good model for all-around work. Many experienced canoemen prefer a longer and wider canoe, and are willing to put up with the disadvantage of added weight on the portages. Canoes are measured "over-all," that is, on the side, along the top strip, from end to end.

Once the canoe is in the water, it naturally follows that the first thing to do is to enter it. But this, to the novice, is no easy task, and, unless he is careful and goes at it in the proper manner, he will probably have his first spill right then and there. There are many wrong ways and only one right way to enter a canoe. Place one foot squarely in the center at whatever place you desire to sit or kneel. Then stoop, while the other foot is still on shore, and grasp the sides of the canoe firmly. Put your weight equally on your arms, so that the canoe is held on an even keel, and carefully lift the other foot in. Kneel or sit down.

Never try to jump into a canoe from a height. Never step in without grasping the sides. Never change position in deep or swift water, but if you must, crawl along on your knees and keep tight hold of the sides. Expert canoemen stand upright and do all sorts of fancy "stunts," but for the novice caution will prove to be the better part of valor.

Having entered it, see that the canoe is properly balanced before you start from shore. If the canoeman is the sole occupant, he should kneel on a coat or a cushion, with his hips against the second brace. Do not sit on these braces. If he has a passenger, the paddler should sit in the stern and place his passenger on a small canoe chair, halfway between the first brace and the point of the bow. Most canoes are provided with a bow seat, which should be removed to avoid accident. Have the weight in a canoe as low as possible and the latter will ride steadily. A load high up above the sides will make the craft top-heavy and easy to capsize.

When the canoe is properly "trimmed," it may be propelled on its course. Two paddles should always be carried, a five-foot bow paddle, to be used by a second paddler, or in an emergency, and a stern paddle seven or eight inches longer. Grasp the paddle with the left hand at the top and the right hand within a half inch of the blade. Put the paddle into the water with its edge at right angles to the paddler. Pull backward with the right hand, push forward with the left, and bring the blade from the water when the right hand is about on a line with the right shoulder. In removing the paddle from the water, twist the right wrist to the right and at the same time push outward with the paddle by lowering the left hand and "rolling" the paddle to the front. This will hold the canoe on its course without changing the paddle from side to side. It is quite a simple trick and one that may soon be acquired by practice.

It is quite another trick to lift and carry a canoe. The average canvas canoe weighs from sixty-five to eighty pounds, and unless the canoeman learns to handle it properly, he may find it something of an effort to swing it to his shoulders and walk away with it. A canoe yoke will make the task easier. Such a yoke can be bought at any sporting goods store. But most woodsmen do not use a yoke; they make use of the paddles for the same purpose. These

are lashed from brace to brace, lengthwise of the canoe, and far enough apart to allow plenty of head room between them. A coat or a pad can be used to protect the carrier's shoulders. Having lashed the paddles, lean over and grasp the forward brace with the hands, the left one near the far gunwale, the right one close to the side nearest the body. Then lift the canoe, on a slant, to the height of the waist and raise the left knee to assist in swinging it above the head, where it should be turned bottom up. Next get beneath the paddles so that one rests on each shoulder, and, when the burden is nicely balanced, proceed to carry it over the portage.

Two boys can easily lift and carry a canoe in the following manner: One at each end, they should stoop over and grasp the gunwales, the near one with the right hand, the far one with the left hand. Next they should lift the canoe, bottom up, over their heads. The boy in front should have a yoke, or he can use the paddles as already explained; his companion in the rear can brace his shoulders against the stern seat.

CHAPTER IV

A Small Sailboat

THE most important part of a flat-bottomed boat is the stem. This should be of good white oak. You can make it yourself, or have it cut out at a saw mill, which is easier. Next, get out the

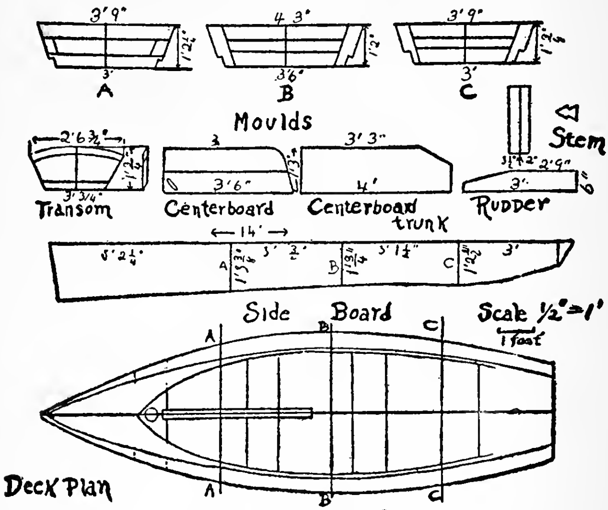


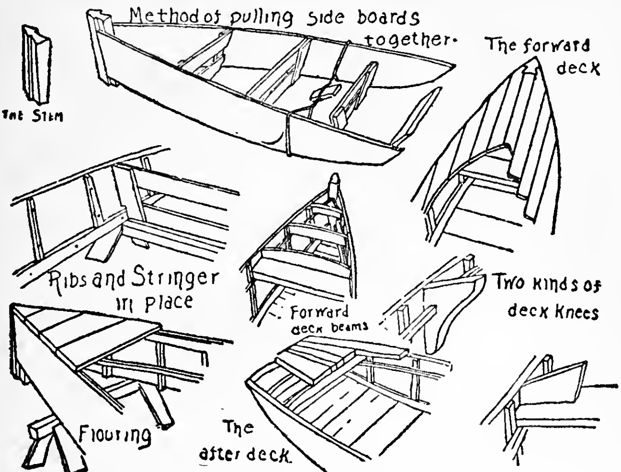
FIG. 1

PLAN FOR SMALL SAILBOAT.

two sideboards. They should be of number one cypress, without knots or sap streaks, three-quarter-inch thick. Lay out the dimensions as shown on the plans, then saw and plane to the desired shape.

When these are done, make the molds. As they are not permanent, they can be made of old material. Be sure to leave a notch in each lower corner, or else the stringer cannot be fitted. Then make the transom, or stern board. This should be of oak.

When ready to set up, nail each sideboard to the stem with a double row of nails. Hold the mold "A" five feet from the end of the stem, bend the side boards around it, and fasten securely. Then hold mold "B" three feet from mold "A" and fasten as before. Be sure to have each mold at right angles to the center line of the boat. To fasten the sides to mold "C" and to the transom it will be necessary to fasten heavy rope around the sides, and twist it with a board in the manner shown in Fig. 2. This will bring it together, and you can fasten to mold "C"



PLAN FOR SMALL SAILBOAT.

and the transom. Never drive a nail without first boring a hole for it with a bradawl. For all permanent nailing use galvanized iron boat nails. These are square cut nails.

Along the bottom of each side put in a cypress stringer seven-eighths inch thick and two inches wide, extending the full length of the boat. It will be necessary to make a few saw cuts near the stern where it bends sharply up.

The ribs are oak, $\frac{7}{8}''$ x $\frac{7}{8}''$ and should be screwed in eighteen inches apart.

To put on the flooring, turn the boat upside down, and plane

off the sideboards and stringer so they will be flat across. Lay several strands of cotton wicking along the edge, and nail the floor boards to both sideboards and stringers. The floor boards should be white pine, as clear from knots and sap streaks as possible. Cypress can be used, but it is not so good. Make as tight a joint between the boards as possible, as there is to be no caulking.

Fasten a strip of Georgia pine $\frac{7}{8}''$ x $6''$ along the outside bottom from stem to stern for a keel shoe. Be sure to get Georgia pine, and not North Carolina pine. Nail with long boat nails clinched on the inside.

Turn the boat over, and put in the seats where shown on plans one and one-half inches from the top. They should be cypress $1\frac{5}{8}''$ x $9''$.

Now the molds can be taken out. When this is done, put in a $\frac{7}{8}''$ x $\frac{7}{8}''$ cypress rib, and just below the seats, extending from stem to stern.

Cut a centerboard slot where shown, two inches wide. Put a post at each end extending from the bottom of the slot as shown in Fig. 3, and nail firmly to both floor and keel shoe. The sides of the centerboard trunk should be in one piece, cypress, seven-eighths-inch thick. Before nailing them on lay two or three strands of cotton wicking where they will join the floor. Put a molding along the corner where the centerboard trunk meets the floor. It would be well to put cotton wicking underneath this, too, as the centerboard trunk is a fruitful place for leaks. The top of the centerboard trunk should be oak one-quarter inch thick.

Put in deck beams, as shown in Fig. 2. Curve them up about two inches in the center. For the side deck, make deck knees like those in Fig. 2, and put one at each seat and one between. Before putting on the deck lay several strands of cotton wicking along the top of the sideboards and nail the deck firmly to the sideboards. The deck should be cypress in strips, $\frac{7}{8}''$ x $3''$.

When the deck is laid, smooth the inside of the cockpit ready for the combing. The combing should be one-quarter-inch oak. Bring it to a point in bow, and finish in the stern as shown on drawings.

Then prepare to lay the canvas deck. Paint the deck with a heavy coat of white paint. Paint the underside of canvas the same way, and lay while paint is wet. Bring the edges over onto

the sides, and nail to side boards with galvanized or copper tacks, placed close together. Nail inside edge to combing. Where edges of cloth meet on the deck, overlap, and paint thickly underneath. Do not tack to deck. Screw a two-inch half-round fender rail over joint between deck and side boards. Nail a half-inch quarter-round molding in corner between deck and combing, as shown in Fig. 3. Screw to combing four oarlock

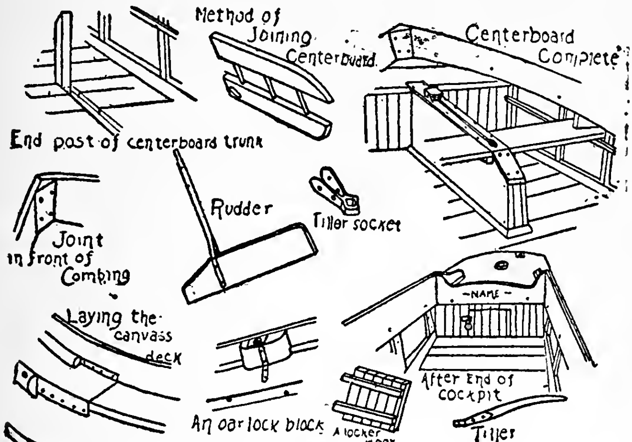


FIG 3

PLAN FOR SAILBOAT.

blocks, as shown in Fig. 3. They should be strengthened with brass angle irons.

For a rudder pipe use a one-inch inside diameter brass pipe. Thread each end, and screw a nut on. Before putting in, line the holes with white lead.

Make the rudder of seven-eighth-inch Georgia pine. For a rudder post use a one-inch diameter brass rod. Square upper end to fit tiller socket. Split the other end and straddle it over rudder. Rivet it with copper rivets. Bore two holes near the top and get a brass pin to fit the holes. This is to hold the rudder in. Make the tiller out of oak. A brass tiller socket such as shown in Fig. 3 can be bought for it. The centerboard should be Georgia pine one inch thick. Make it out of two pieces dowelled

together, as shown in Fig. 3. Use brass rods for dowels, and be sure to bore the holes for them straight and of the same diameter as the rods. Make a five-inch slot in one corner to permit the centerboard being dropped as low as possible. Fasten centerboard in with an oak pin. Fasten a brass rod to top to raise and lower it.

Make a mast hole in foremost thwart, or in forward deck. Line it with leather. Place an oak mast step on the floor directly beneath it. Make a locker at each end of boat, using beaded cypress.

Paint the whole boat with three coats of good paint. Paint the centerboard and centerboard trunk before putting them together. Use deck paint for the deck. All varnished work should be varnished with good spar varnish. Do not try to economize by using cheap varnish. It won't pay.

Obtain a mast. For the boom and sprite, get 2″ x 2″ spruce. It will be easier to round it if you get the corners cut off at the sawmill.

The easiest way to get a sail is to have it made at the sailmaker's. When giving him the dimensions, if you are having the spritsail made, be sure to give him the corner-to-corner dimension. If you are making it yourself, overlap each piece of cloth about an inch and sew with a double row of stitches. Sew a light rope around the edge, leaving a loop at the outside corner, as in drawing.

To fasten on the leg-of-mutton sail, lash it firmly to the mast hoops. Run the hilliard from the top of the sail, through a pulley at the top of the mast, and belay—that is, fasten—on a cleat near the bottom of the mast. To set the sail, insert small end of the boom into loop on corner of sail, and stretch sail as flat as possible. Fasten a rope, having a loop in one end, to the mast with a double half-hitch. Run free end of rope through slot in end of boom, through loop in other end, and fasten to boom with double half-hitch, as shown in Fig. 4.

If using the spritsail rig, lash the sail permanently to the mast. Set the same way as leg-of-mutton sail. The sprite is the spar that holds up the upper corner of the sail. This is put on the same way as the boom. The main sheet—as the rope that hauls in and lets out the mainsail is called—should be belayed or fastened on a cleat on one side, rove—that is, passed—through a pulley on the boom and belayed on the other side.

Fasten the jib to eye-bolts in stem and masthead with snap hooks. There should be two jib sheets, one on each side, led through eye-bolts, and belayed near mainsheet.

Bolt a large cleat through forward deck, and put a chock on each side of bow. Put four oarlocks on the sides, and one in the stern. Put a cleat in the stern.

A twenty-pound anchor will be about the right size.

The spritsail rig is the best for rough water and high winds, and is easy to handle, but the boat is very much undercanvased rigged

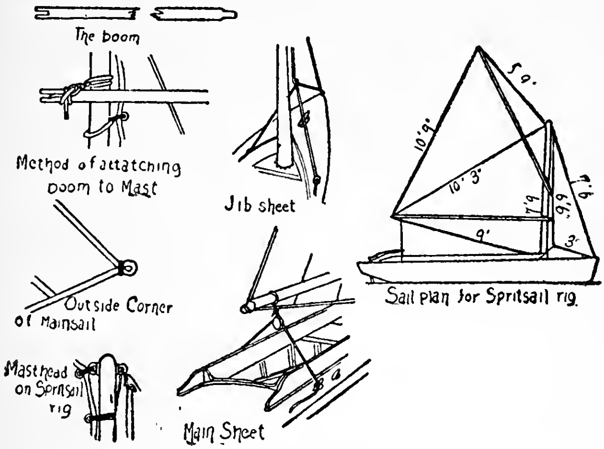


FIG 4.

PLAN FOR RIGGING A SMALL SAILBOAT.

this way. If you want more sail, use the leg-of-mutton sail. The mast for spritsail should be nine feet six inches high. For leg-of-mutton, it should be twice that height, but should taper very much toward the top.

The cost will, of course, vary with the locality and the fittings. The lumber, with the exception of the centerboard, rudder, and spars, will cost about eight or ten dollars. You can have the spritsail made for about five. The whole boat complete would cost eighty dollars at a shipbuilders, and you can build it for less than half that sum.

CYPRESS

Two pieces $\frac{3}{4}$ in. x 18 in. x 14 ft.
Two pieces $\frac{7}{8}$ in. x 2 in. x 14 ft.
Two pieces $\frac{7}{8}$ in. x $\frac{7}{8}$ in. x 14 ft.
One piece $1\frac{7}{8}$ in. x 9 in. x 12 ft.
One piece $\frac{7}{8}$ in. x 1 ft. 3 in. x 8 ft.
One piece $\frac{7}{8}$ in x 3 in. x 12 ft.
One piece $\frac{7}{8}$ in. x 2 in. x 1 ft. 9 in.
Four pieces $\frac{7}{8}$ in. x 3 in. x 18 ft.

OAK

One piece 6 in. x 5 in. x 12 in.
Two pieces $\frac{7}{8}$ in. x $\frac{7}{8}$ in. x 14 ft.
One piece $\frac{7}{8}$ in. x 13 in. x 2 ft. 7 in.
Two pieces $\frac{1}{4}$ in. x 6 in. x 11 ft.
One piece $\frac{1}{4}$ in. x $3\frac{1}{2}$ in. x 3 ft. 9 in.
One piece 1 in. x 4 in. x 4 ft.

GEORGIA PINE

One piece $\frac{7}{8}$ in. x 6 in. x 14 ft.
One piece 1 in. x 7 in. x 7 ft.
One piece $\frac{7}{8}$ in. x 6 in. x 3 ft.

WHITE PINE

Five pieces $\frac{7}{8}$ in. x 6 in. x 16 ft.

CHAPTER V

How To Sail a Boat

Now you know how to build a boat, but it is no good to you until you learn how to handle it. A careful study of this chapter will give you the general principles of the art. You will find it not difficult.

The wind has four different effects on a sailboat, which must be understood by the amateur sailor before he can begin to see why his boat performs differently under different conditions of wind and sailing course.

The wind drives the boat ahead—most important of all; it also drives it laterally or, to speak in a nautical term, causes it to "make leeway"; it heels the boat over, and, lastly, turns it around, according to the balance of her sails, distribution of weight, and what is known as the "center of lateral resistance." The proper handling of sails and rudder is what enables the sailor to so utilize these effects of the wind that he may sail his boat in any direction.

The propelling effect is the one most utilized, and it is for this reason that every boat is constructed to offer the least resistance to its forward movement with as little friction as possible.

Leeway is one effect to be avoided, and for this purpose boats are given either deep, stationary keels or centerboards, or some other device for providing an extensive lateral surface below the water.

Heeling and the stability of a boat go hand in hand. The boat must be prevented from capsizing, and this is done either by putting lead or iron on the keel, or carrying ballast in the hull in order to lower the center of gravity, or by building a broad and shallow boat such as the cat boat, which is very stiff in a breeze and does not heel readily, but when a certain point has been reached, is apt to capsize quickly in the hands of an unskilful sailor.

The fourth effect is that of turning the boat around. This is done when the center of effort on the sails does not come on a line

with the center of lateral resistance. This is always the case in a poorly balanced boat. A well-balanced boat requires very little movement of the rudder to hold to a course.

Any novice can understand how a sailing boat can travel with the wind, but why it should go forward when the sails are close hauled is a question of dynamics which we will not try to explain in this short article. An easily understood explanation of why boats go ahead instead of sideways can be made by taking a V-shaped block of wood and pressing it between the thumb and forefinger. If sufficient force is used it shoots forward quickly. The thumb may be likened to the wind and the forefinger to the water on the opposite side of the boat. The pressure caused by the wind pushing the boat against the water on the opposite side causes the boat to go forward.

The center of effort and center of lateral resistance must be understood in the handling of a sailboat. The center of effort is the center of the total sail area. If, for example, this comes forward of the center of lateral resistance when the boat is sailing with the wind abeam, then the side pressure on the sails will turn the boat's bow in the direction toward which the wind is blowing, or away from the wind, and a boat doing this is said to carry a "lee helm."

On the other hand, if the center of lateral resistance is farther forward than the center of effort, the wind will swing the boat in the direction in which it is blowing, thus throwing the bow up into the wind. A boat doing this is said to carry a weather helm. Every sailing boat should be so rigged as to carry a little weather helm, as, if struck by a squall under those conditions, it will luff quickly up into the wind and so be in safety, while if the lee helm is carried, the boat will fall off before the wind, presenting a broadside to wind and wave which is very apt to cause it to capsize.

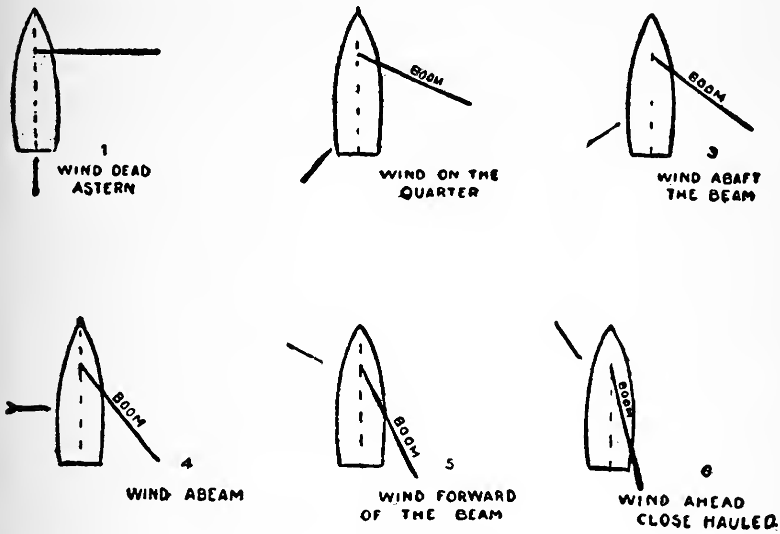
Too much weather helm is also to be avoided, as it makes it necessary to keep the rudder over at a sharp angle and retards the progress of the boat.

To reduce weather helm, move the ballast aft or shorten the after canvas, or increase the forward canvas by setting a larger jib. If a boat carries a lee helm, shift the ballast forward or reduce the area of the head canvas.

In considering the action of the rudder, the amateur sailor should

bear in mind that as the boat is turned by the rudder, it swings as on a pivot. The water, pressing against one side of the rudder, pushes the stern of the boat away from that side.

The pivot or turning point is always well forward of the center. This is a fact that should be remembered when steering close to a boat or other object. Don't delay turning out of the way too long, or the very act of turning your boat will throw the stern over sufficiently to cause the collision you are trying to avoid.



SAILING.

Running before the wind may look like the ideal course to the amateur sailor, but a little experience cures him of that belief. Figure 1 shows the location of the sail when on this course. Steering is difficult when running with the wind aft, especially in rough water, and there is danger of the sail gybing over when least expected. Except on smooth water it is better to haul the boat up so as to have the wind on one quarter, and after following that course for some distance, to "take the other tack," gybe over so as to bring the wind on the other quarter. Figure 2 represents the wind on the quarter. Figure 3 shows the wind abaft the beam.

Figure 4 shows the wind abeam, or directly at right angles with the boat. Figure 5 shows the wind forward of the beam. Each figure shows the proper location or direction of the boom, or, in a nautical term, how the sail should be trimmed. All of these are what are known as favorable winds, the sheet being hauled in such proportion as to give the best results. The positions in all of these figures show a boat when it is what is termed "sailing free."

To sail "close hauled" means to bring the boat up as close into the wind as possible and still keep it on its course, with the wind filling the sail so as to drive it forward. A properly built boat will lie within four or four and a half points of the wind, while some, especially those built on racing models, will do even better than this. Figure 6 shows about the proper location of the boom when sailing close hauled. The wind striking the sail at this angle will drive the boat forward and maintain a reasonable degree of speed, while to haul it closer would increase the leeway until, if the sail were hauled parallel with the keel, the only progress made would be to leeward. Most boats will sail closer to the wind in smooth water than in a rough sea.

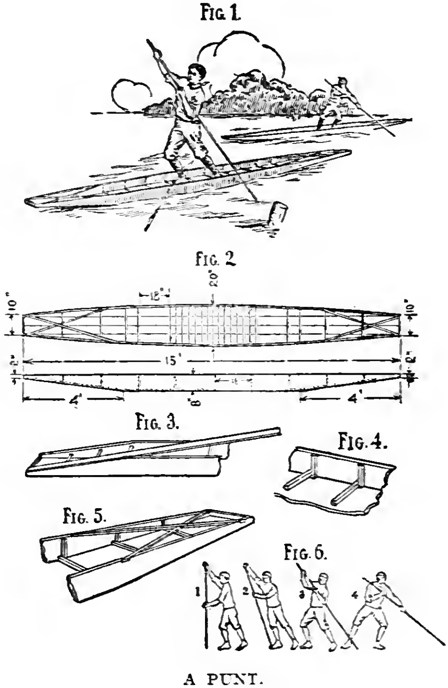
When sailing close hauled, it is necessary to hold the boat on a course that will just nicely keep the sail filled with wind. This point can be ascertained by putting the helm slowly to the leeward. As soon as the sail begins to shake near the head, you have reached a point where it is not drawing as much as it should, and, if the helm is kept down, the sail will begin to flap in the wind and the boat will lose headway. A little practice will enable an amateur skipper to see the beginning of this "tremble" in the sail, and at the first symptoms he must reverse the helm until the wind fills the sails fairly.

CHAPTER VI

A Punt

THE boat shown in the accompanying sketch is intended for use in a shallow pond or marsh. The craft is a flat-bottomed, one-passenger affair, and is poled along.

A complete view from the top and side is presented by the cut marked Fig. 2. Our first work will be to saw out the two eight-foot side boards, which we might dignify by the name of gunwales. For those is recommended cypress, one inch or more in thickness. Next, put in the center floor timbers, which are two inches square and twenty inches long. Put in the one in the exact center, keeping its lower edge a half-inch up from the lower edge of the side board. Next put in the stem and stern pieces, which form the ends of the boat. These are only ten inches long, so the sides will be bent. You may now put in all the other floor timbers, eighteen pieces, to conform to the shape and dimensions of the diagram in Fig. 2. The short side braces, or ribs, are now attached as shown in detail by Fig. 4.

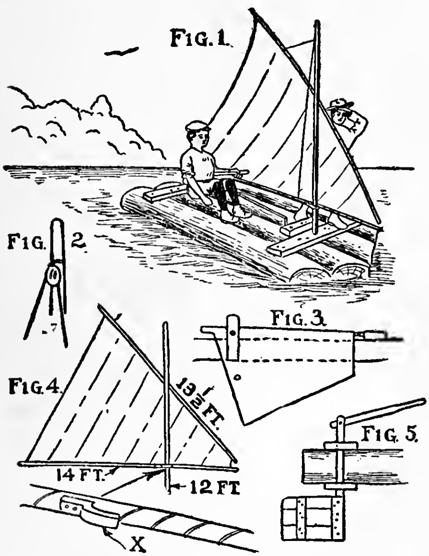


A PUNT.

In Fig. 5 you get a good view of the pair of braces put on the top edges of the gunwales, in X shape. These will add strength and rigidity to the ends and should be securely fastened with long, slender screws.

The best material to use for the bottom boards is half-inch matched flooring. Clear pine will do as good as any, but the tongues and grooves must be coated with a thick mixture of white lead and oil before being put together. The edge pieces, which are curved, will tax your patience. The crack should be puttied and battened with a long strip. Before the boat gets any wetting at all it must receive three thorough coats of paint inside and outside.

The pole used may be a bamboo fishing rod or a sapling of sufficient lightness. Figure 6 is a diagram of how to start and end the stroke. Racing in punts of this type is fine exercise, and for frog and turtle hunts they can't be improved upon.



A LOG CRUISER.

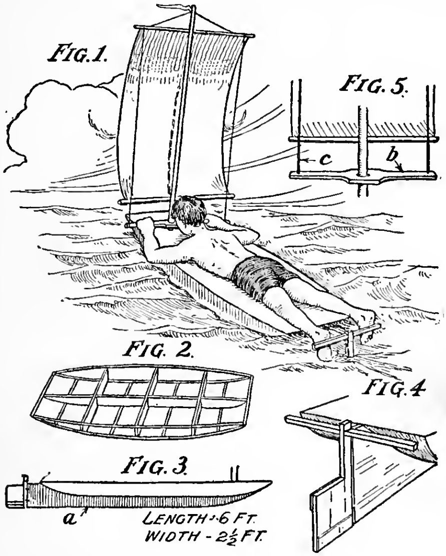
A LOG CRUISER

The boy and the pond have ever been close companions. Surely you can find four good stout logs and cleat them with pieces of scantling firmly spiked on. It is best to have the fore end of the raft pointed as shown, for it will break the waves and cut through the water more easily. Between the second and third log is a centerboard just like Fig. 3. It hangs down into the water and can be raised and lowered at will. The rudder plan is made clear by Fig. 5. The sail is the most difficult part to make. Use a sapling for

a mast and brace it with two wires stretched from its highest point to the front cleat. Figure 4 shows the size and rigging of the sail. If you cannot afford a sail you can paddle the raft.

SWIMMING SAIL RAFT

The clever and unique device pictured herewith may be made by any boy who cares to possess one. Study the pictures, for they will teach you more about the construction than a whole page of text. The making of the body part is shown in Fig. 2. It is like a shallow boat and must be covered with watertight canvas.

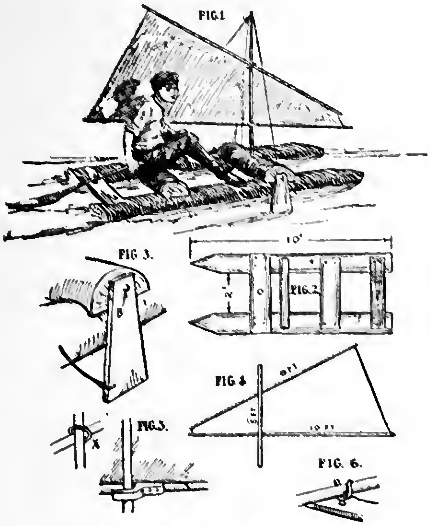


A SWIMMING RAFT.

A soap box, torn apart, will provide material for the rudder, as illustrated by Fig. 4. The sail is three feet wide and five feet long. Tack a stick along the top and bottom edges, and by means of these cross-arms lash it to the mast. The mast fits into a square hole and does not turn. The sail turns around it and is operated by the handlebar *b*. A keel added to the bottom will give greater buoyancy and at the same time add steadiness to the craft.

A SAILING CATAMARAN

The catamaran is the original and oldest type of boat. It was the first crude attempt of primitive man to control the direction of the log upon which he desired to float. Later, perhaps hundreds of years, the one log affair developed into a craft that consisted of three logs lashed together and pointed at the fore end, just like a gigantic toy boat that a ten-year-old boy would whittle out of a shingle as big as the side of a woodshed.



A SAILING CATAMARAN.

The plan shown here is copied after the ancient idea and is intended for use at a summer camp or swimming hole. The main part of the craft is two logs ten feet long and fourteen inches or more in diameter. If you camp near a lake or river it is probable that you can find fallen trees conveniently located for the purpose. Taper them down with an ax and lay them on a low bank two feet apart. The manner of placing the cross-braces is shown by "F," Fig. 2. Spike them well and then drill holes with a long bit one inch in diameter. Into the holes drive tight-fitting wooden pegs. You can make it very strong and rigid this way, for all the old-time houses in this country were built with wooden nails. In Fig. 3, B represents a lee board nailed to the end of the fore brace or thwart. The boards, there is one on the other end of the same log, dip down into the water and serve the same purpose as the centerboard of a sailboat, that is, to keep it from drifting sideways or capsizing. An oarlock on the rear cross-piece serves as a

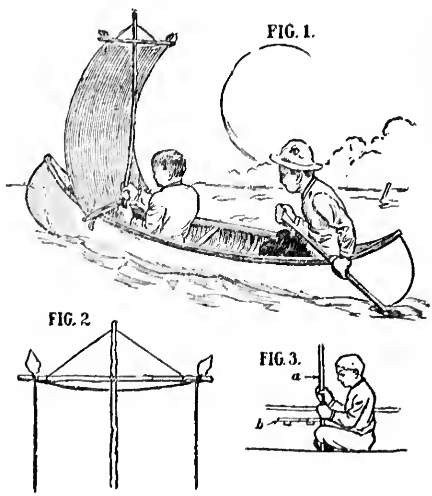
seat for the rudder oar. This oar may also be used for sculling. Figure 6 shows the detail.

Figure 4 shows the sail plan and dimensions clearly. Figure 5 shows the cleat by means of which the boom of the sail swings on the mast. A heavy wire ring directly above this cleat is marked X. The mast is a hickory pole eight feet long and four inches in diameter. The lower end of it is squared and sunk into a square hole, a few long nails being toed in to steady it. The mast is then braced with wires leading from the top to the log platform.

There is a world of fun in this homely craft, but, it is needless to say, you must be a good swimmer if you want to go into deep water with it.

A CANOE STUNT

A few years ago two friends took a trip up a river in a canoe. The stream is nearly a mile wide and quite shallow, so it goes without saying that if there was any breeze blowing they were sure of getting their share of it. After ten hours' paddling rapids were encountered, and they had to make a portage to a parallel canal nearby. The first night they slept in the woods with the canoe for a bed and a large canvas coverall for a shelter. They simply hung it from a line that ran the length of the boat, dog-tent fashion. Imagine a carpet doubled over a clothesline, with each edge resting on the ground and held three feet apart by means of small stakes. The next day they went five miles on the canal and made a portage back to the river. Then a thunder-storm accompanied by a deluge of nice wet summer rain dampened their plans and them-



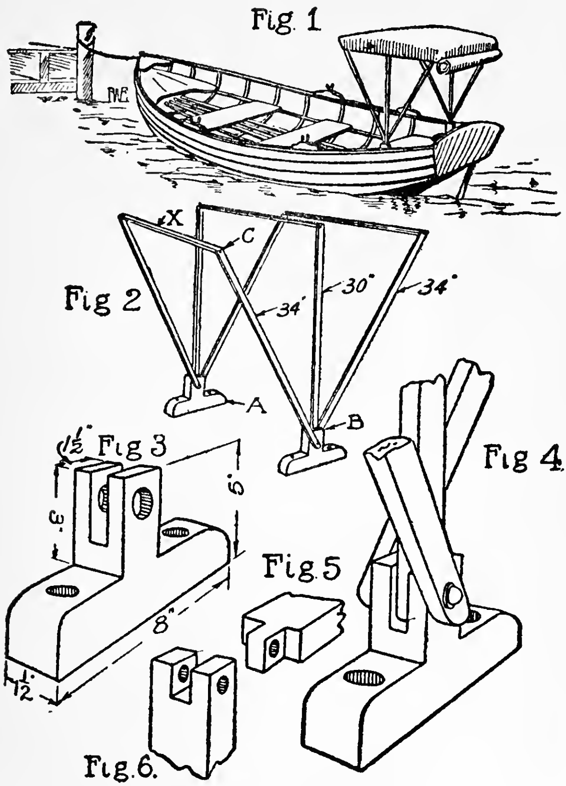
A CANOE STUNT.

selves. This time they took refuge under an old bridge and used their canvas to curtain off the angry weather. After the rain they cast away all excess baggage, such as bait and spoiled lunch, and started for home. Although it was summer the river was choppy, and a strong gusty wind lashed them from behind. Again they requisitioned the canvas. This time they made it into a square sail as shown in the picture. For a mast or upright stick they used a fish pole, simply holding it as firm as possible, as in Fig. 3. Branches cut from a tree served as the cross-arms at top and bottom. One of the friends sitting at the stern used the paddle as a rudder. The trip home was made in just one-half the time it took to paddle up. When they arrived at the park from which they had started not one boat was to be seen braving the elements, and much was the surprise of hundreds of owners of small craft to think that they had nerve enough to venture out in a canoe. With no effort at all they made from seven to nine miles an hour. Don't neglect to take along a big canvas. As the old sailor says: "It's useful for anything from swaddling clothes to winding sheet."

BOAT SHADE

Here is an easily made article that adds to the comfort of your rowboat trip. It need hardly be said that it may also be made and attached to a canoe or any type of small boat. The first and hardest part to make is the base block shown in Fig. 3. It is fashioned out of two pieces of hard wood. If you have no small saw, you can cut it to shape with a common hand saw by exercising your stock of patience. Finish by sandpapering and giving two or three coats of oil and one of good varnish. The lower ends of the upright sticks are inserted as in Fig. 4. One of them is in the center slot and one on each side of it. A short bolt passes through the three. The joint used for fastening the upright sticks to the cross sticks on top is shown in Figs. 5 and 6. The sticks should be of seasoned ash about one-inch square. You can get them at a carriage shop or repair place, or lumber yard. The putting on of the canvas is too simple to require explanation. Simply stretch it over the top, draw it down the side a few inches, and tack it in place. The shade may be tilted in any direction or laid flat. It may also be taken off the boat quickly by unscrewing the four

nuts that hold it. If you do not intend to remove it when not in use, have the nut under the seat and the head of the bolt on top



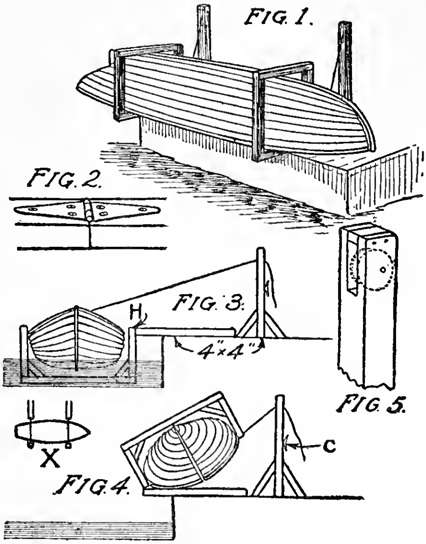
BOAT SHADE.

instead of the opposite way, as it would be easy for some one to appropriate your shade for their own use.

BOAT LIFT

It is quite a little task to get a boat out of the water; in fact, it is seldom effected without a scraping off of the paint or a straining

of the back of the lifter, which is a catastrophe not to be laughed at. Here is an easily made, permanent device, which will remove the difficulty. It is a permanent fixture, and will be equally useful for launching purposes in the spring. First set up two 4 x 4 inch posts on the dock, making them firm by bracing. Saw a block out of the top of each and in the spaces set pulleys, as in Fig. 5. We now make two frames out of 4 x 4 inch stuff, using three pieces for each and bracing each as indicated by Fig. 3. Those



A BOAT LIFT.

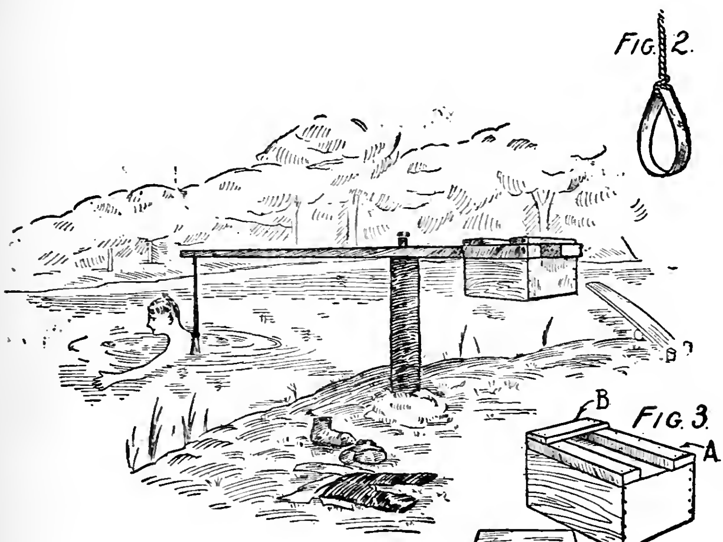
frames are then hinged with large, strong strap hinges to the flat pieces, which have been spiked to the dock and which extend about a foot over the edge of same. It is used by simply gliding the boat along into the pocket formed by the two frames, then attaching the ropes and pulling up slowly. The surfaces that the boat must come in contact with should be padded with large rubber hose. There is no danger of the boat falling out, because the ropes bind on the top.

CHAPTER VII

The Boy Swimmer—Devices That Will Aid Him

A SWIMMING TEACHER

HERE is a swimming teacher, designed somewhat along the lines of the old-fashioned ducking stool. You know, in the early New England days, one of the modes of punishment was to fasten the offender on the end of a plank that reached out into the water, and



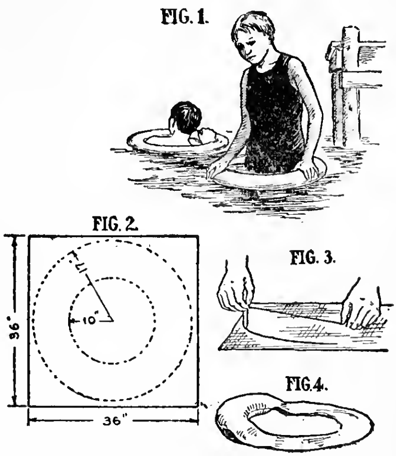
A SWIMMING TEACHER.

was pivoted in the center like a see-saw, and duck him down under the water. It was not very pleasant in the chilly winter days, but in the summer time probably the wicked lads did not object very much to the forced bath.

Our device will really be useful in learning how to swim. Sink a sound post two and a half feet in the ground and bore a one-inch hole in the center. Then bore your plank and fit in the bolt. A little lard or wagon grease rubbed on occasionally will make it turn more freely. The box on the end is intended to balance the swimmer. It is made so that it can be filled with stones or sand, and also to permit of being slipped off. If there is some one near who will hold the end down you can dispense with the box. Another way to use it is to fasten the weight end to the ground with ropes or wire and dive off the other end, spring-board fashion. It also serves as a whirligig.

SWIMMING HELP

To say that every boy should learn to swim is simply to repeat an old truism of self-evident worth. The question is how can one learn to swim without risk? Our little plan is one answer to the



SWIMMING HELP.

query. It is a home-made life preserver, and here is how to make it. Get a square yard of canvas and tack it down on the barn floor. Find the center and stick a nail in it, then with a string

seventeen inches long draw a circle, as indicated in Fig. 3. The inside radius is ten inches, leaving a ring between the concentric circles seven inches in width. This is cut out with a scissors, and two of them like Fig. 4 are sewed together on the edges of the inside ring and on the outer edges, with the exception of an opening of seven inches. The sewing can be easily done on a machine. Two or three rows of stitches should be taken.

The hollow ring is now filled with ground cork. Common corks may be chopped as fine as coarse smoking tobacco by putting them through a food chopper twice.

Ram the cork in good and tight and then sew up the opening. This float will be buoyant enough to keep you afloat and you can propel yourself by only a slight motion of the arms and legs. After you get used to it you can gradually let it come higher and higher on the body, until finally you will not need it at all. It is a good emergency life preserver, and many a lad could have been saved if something like it was near to give him a little confidence and support.

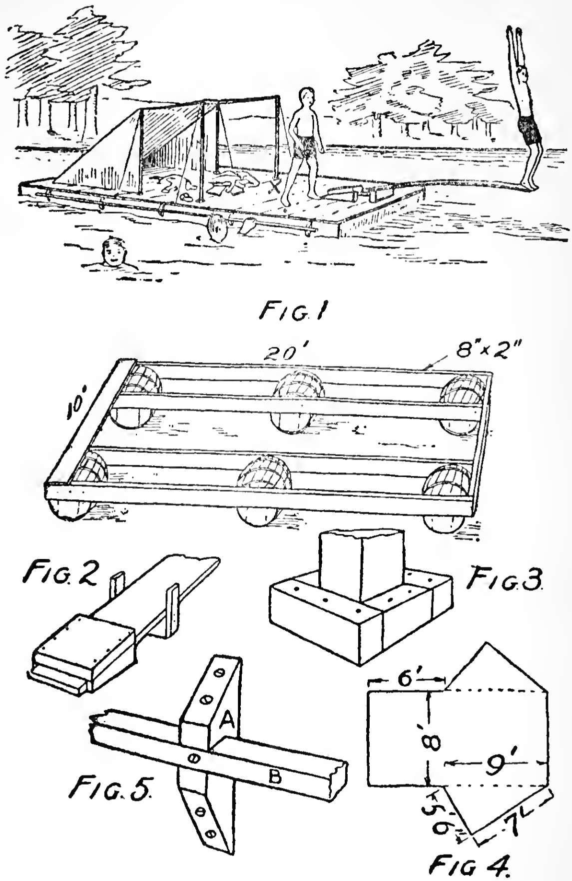
It is a known fact that the human body cannot sink in deep water until it fills with water. Just lie back on the surface and let yourself sink gradually; you will go under water a few inches and will bob up again, then down a little less than the first time and up again, finally coming to a rest with just about half of your face above water. This is ample for breathing purposes, and you could rest for an hour if you could keep quiet that long. The trouble is, a swimmer wants his head and shoulders above the water and it takes a good deal of continuous effort to keep them there. Have just as little of your body above water as possible.

A SWIMMING FLOAT

If there is anything on earth that will provide more fun for a typical bunch of live American boys than this float, it is hard to imagine what it could be. You can dive off it, you can fish off it, you can haul it in close to shore and spend your camping nights on it, you can paddle the whole business like a raft, you can float down stream in houseboat fashion, but what's the use of going further. What you do need mostly is a clear creek, not too wide and not too narrow, shallow at the shores and deep enough in the

middle to allow straight-down diving. Next a half-dozen or more companions and the fun is on.

The making of the float is simple enough for the average boy to attempt. With three or four to help you the work should be com-



A SWIMMING FLOAT.

pleted in about two days. The first thing you need is six water-tight barrels. You might paint them with tar or pitch as an extra

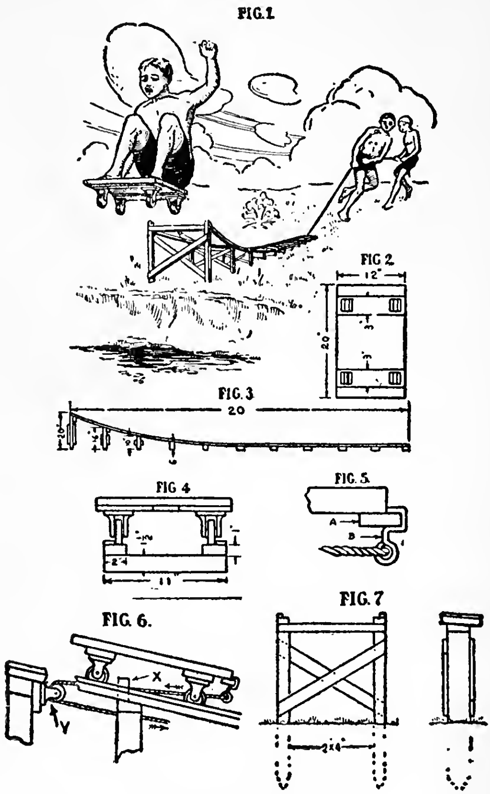
precaution against leaks. Now stand three in a row on end with a distance of twenty feet between the first and last and the odd barrel midway between them. You now place a 2 x 8 inch timber on top of the three barrels and spike it so that the edge extends an inch over the edge of the barrel top. Now turn the whole thing over and spike another twenty foot timber on the other side. Three more barrels are treated in the same way, and then you connect them with cross-timbers ten feet long. This completes the foundation of the float and should look like Fig. 1. If you study this drawing for a few minutes all the details of construction will become very plain. You will observe that it is quite a heavy affair and for that reason your building operations should be carried on close to the water's edge.

The next step is to nail on the cross-pieces, which form the floor. It would be best to have large heavy planks that run all the way across, but if they are too expensive for you, use all the scrap pieces of lumber you can get hold of. Drive all the nails in below the surface and cover with old carpet or canvas. The spring board is an essential part and must be well made. Figure 2 is an enlarged section which shows how the end is held down. By this simple arrangement any desired tilt or angle may be secured by shoving the board further in on the raft or pulling it out more to the water. Side rails may be fastened to the raft to enable you to climb back out of the water. Figure 5 shows how the rail is secured. "A" is one of the blocks to which the pole is fastened, "B" is the pole itself. The canvas shelter is a simple affair, but it will be found very useful. It will save you from the scorching sun while you are resting and permit you to enjoy a swim when it is raining, a sport that boys are fond of. Four poles about five feet high are erected, being secured at the base in the manner shown by Fig. 3. The exact shape and size of the canvas used is shown by Fig. 4.

That about finishes the float. Large logs may be used as a substitute for the barrels if they are easier to obtain in your locality. Now, then, boys, get your crowd together and make one of those fun devices. It will last for years and furnish you plenty of good, wholesome amusement.

SHOOT THE CHUTE

A sudden dash, a lift into the air, and a plunge into the cool water,—that has spelled amusement for centuries. In a hundred



A SHOOT THE CHUTE.

forms the idea has been worked out, in cold countries and warm countries, among savages and in the joy farms of our big cities. In the accompanying drawing we show how a toboggan may be set up at the waterside. The drop should be into the water at least

five or six feet deep, so in most cases a considerable part of the slide will be over water.

The first thing to do is to sink heavy posts in the shallow water. Use oak or cedar posts in preference to those of any other wood. The ends should be pointed, and the top of the one being driven should have an iron ring or ferrule so that the blows of the sledge hammer will not split it. When it is deep enough, you may take the ring off and use it for the next post, and so on. Drive a post every two feet lengthwise, and keep the two rows fifteen inches apart. In this plan the car is pulled to the edge with boy power, so there need be only a slight slope from the starting point to the end of the run. Use 4 x 4 stuff or round stock four inches in diameter for the supports. Drive them straight and brace each pair together with 2 x 4 scantling nailed in "x" shape. Similarly brace each pair to the next adjoining pair.

In Fig. 3 you may see the elevation at the end and how the final rise is effected. The track consists of one-inch boards nailed to the posts. The boards should be submerged in water a week or two before being used, as they must bend readily. On the top surface, near the outer edge of each board, nail a strip, which will keep the car from running off. The wheels of the car fit between those strips, as in Fig. 4.

Figure 2 is a flat view of the car and shows all dimensions. The wheels of the car are roller skate rollers. Study Fig. 5 for a few minutes. There is a piece which projects back from the under side of the rear of the car marked "A." "B" is a bent piece of strap metal which fits over this, and to it is fastened the rope. Under the highest end crosspiece is a pulley through which the rope is threaded and then passed downward and back to the starting point.

Figure 6 shows the car and rope arrangement beyond my power to improve with mere words. After the passenger is seated the line is pulled in the direction indicated by the arrows, and away somebody goes at a mile a minute speed, then when you hit the sudden rise, the block "x" stops the hook and the car is projected into the air five or six feet. That is why you must have deep water to land in. If loud laughter and fresh air are good, certainly this plan has much to commend it.

PART III

THE OUTDOOR BOY AT HOME

CHAPTER I

Easily Built Means of Locomotion

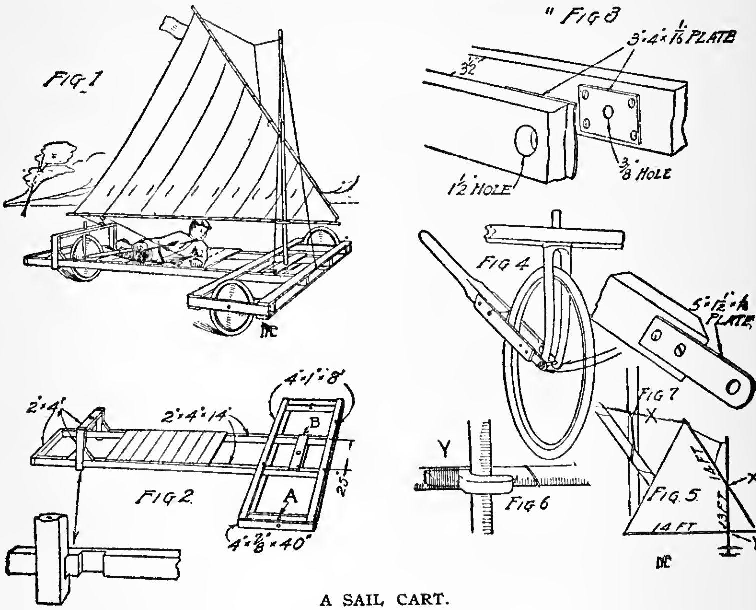
A SAIL CART

HERE is an amusement device that will appeal to boys who live in regions where large flat spaces are available.

The first part of our work is to construct a suitable frame. This is pretty clearly shown in Fig. 2. Its extreme length is fourteen feet, width four feet. At the rear end we erect a truss for the single wheel. This truss or raised part is necessary because we use a bicycle fork for the single or steering wheel and must have something high enough for the entire wheel to fit under. Bicycle wheels are used because they are hung so accurately and have ball bearings which make the smoothest and easiest running possible. You can get wheels at the junk dealers or second-hand store for a trifling sum. It is not necessary that good tires be fitted to the wheels, but of course it would be a good thing if you can afford them. Notice on your bicycle wheel that the part which is called the cone does not turn; the wheel itself turns, but the axle does not turn with it. Inside the hub of the wheel are small steel balls, and fitting close to those is the cone, the balls being between the two. If the wheel you are going to use is very old, take out the cone, clean the groove in which the bearings turn, and when you replace them plaster them with vaseline. This will make oiling unnecessary for a long time.

Between the two strips, "A" in Fig. 2, is where we hang the fore wheel for the left side. In a similar space on the other side we hang

the other fore wheel. Over the holes which have been bored in the wood we fit metal plates, suitably bored to accommodate the cone you are using. This is clearly shown in Fig. 3. In the one and one-half inch hole to which the arrow points the nut that tightens the cone in place is imbedded. The hole is large enough to admit the nose of a pair of pliers any time you wish to tighten it up. The attaching of the fore wheels is simple enough, but it must be carefully done if you wish the best results.



A SAIL CART.

The rear single wheel is the one we steer with. It consists of an entire half of a bicycle, fork and all. It is simply placed under the truss and up through the hole that has been bored in the center. A handle or tiller for steering it may be attached to the cones as shown in Fig. 4. This does not permit the wheel to be turned all the way around, but you very seldom would want to do that, and a pretty sharp turn can be taken. If the wheel would turn clear around there would be danger of an accident. The steering handle

is attached to the wheel by means of small metal plates as shown in detail in the sectional sketch of Fig. 4.

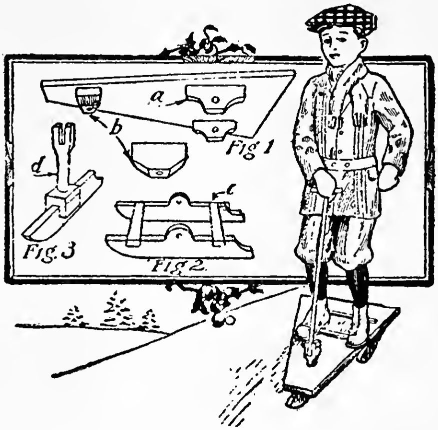
When the wheels are in place and working nicely we take up the sail part of the cart. Look at the central part of "B" in Fig. 2 and you will note a hole is bored through the top crosspiece. Into this a mast thirteen feet long is placed, so that it will rest on the under crosspiece. Complete dimensions of the sail are shown in Fig. 7. If you know anything about rigging a boat you can utilize it here, for the same ideas are used. The mast is held upright and braced by three wire stays leading from it to the top of the framework. The fork which permits the sail to be swung to the right or left is shown in Fig. 6.

If you refer constantly to the drawings you will be greatly aided in the construction of the sailer. In operating it you might wish to know beforehand some of its uses and possibilities. It cannot be run directly against the wind any more than a sailboat can, and yet, as sailboats can reach a point in any direction if there is wind, so can this cart. If the road is wide or if you have access to the wide stretches of hard sandy beach that abound in the South you can get along nicely with it. A country road in good condition makes a suitable field of navigation if the wind is right. It is a very useful and easy running cart even if you wish to dispense with the sail part altogether. It is a good coaster or may be fitted with levers to run by pushing back and forth.

A SINGLE COASTER

Here is a handy little single coaster that younger lads will like. You can make it yourself, at very little expense. A piece of plank thirty-six inches long and twelve or fourteen inches wide is needed for the top. Another piece of forty-eight inches length will, when cut up, furnish the runners and blocks needed. Saw off a triangular piece at each side, leaving the small end seven inches in width. Then cut out two blocks like the one marked "a" in Fig. 1. Those must be fastened very firmly to the plank. Use long screws and bore a hole for each screw to avoid splitting the blocks. The fore block "b" is screwed flat to the plank. From the under side bore an inch hole through both. Figure 2 shows how the rear runners are made. The cross braces are sunk into the runners as shown

by "c." To attach the rear runners put a long bolt through the holes in "a" and the central raised part of the double runner. This method gives the sled a springy, elastic motion that is very exhilarating. The single runner in front is used to steer. Figure 3 shows the construction more clearly than a whole page of text could. The lower end of the stem "d" should be squared and should fit into a square hole. If you can, it is well to reinforce the runners with metal strips, but it is not necessary if you use hard wood. The coaster has a variety of uses. It is good on the ice or on a hill. Along the road it is as spry as a rabbit. Run along and,



A SINGLE COASTER.

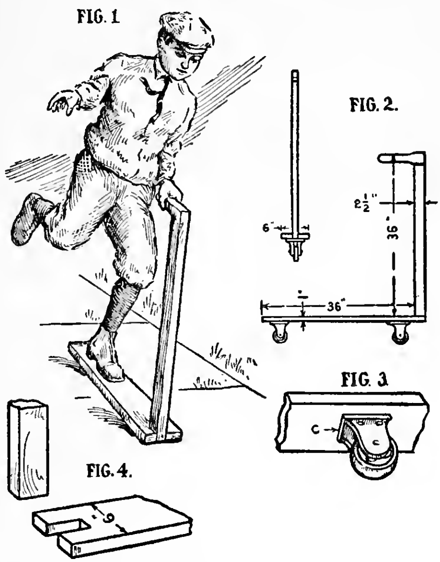
when you have a good start, hop on. You can easily keep it going by kicking back, and can even go up grade. If there is any snow or ice within reach and you have one of these coasters it is certain that you will not lack good, wholesome, outdoor exercise.

SCOOTER

Here is a speedy runabout for the young lad who has oceans of energy that he must rid himself of. One glance at the picture will give you about all the information you need.

For the platform select a sound one-inch board six inches wide and thirty-six inches long. At the fore end a notch is sawed for the

upright stick. This latter is thirty-six inches long and two and one-half inches wide. It must be fastened securely so that it will not wiggle or bend. At its top end is a hand piece used in holding on and steering. The wheels are small, of solid metal, or rollers taken from roller skates. The manner of putting them on is well shown by Fig. 3. This picture shows one roller in front and one in



A SCOOTER.

the rear, but by using a wider board you can have two rollers in the rear if you wish.

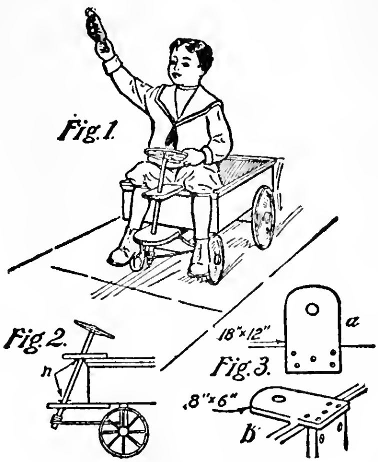
It is used by running along and occasionally kicking behind. Good smooth cement is the best runway, and offers a chance to attain great speed

STEERING GEAR

Here is a plan for adding an automobile steering gear to a little wagon. If you are so big that the plan doesn't interest you, rig it

6

up for your younger brother and you will have his everlasting gratitude. Here's the way the thing is done. Get a piece of pine board one inch thick and cut it to the shape and size shown in Fig. 3. Fasten it to the under side of the wagon with five screws. To do this properly you must first tack it with nails, and then bore a hole for each screw. The holes should be as large in diameter as the shank of the screw, only the thread being imbedded in the wood. The large hole for the steering post is bored at the angle shown in Fig. 2. The piece "b" in Fig. 3 is 8x6" and is fastened

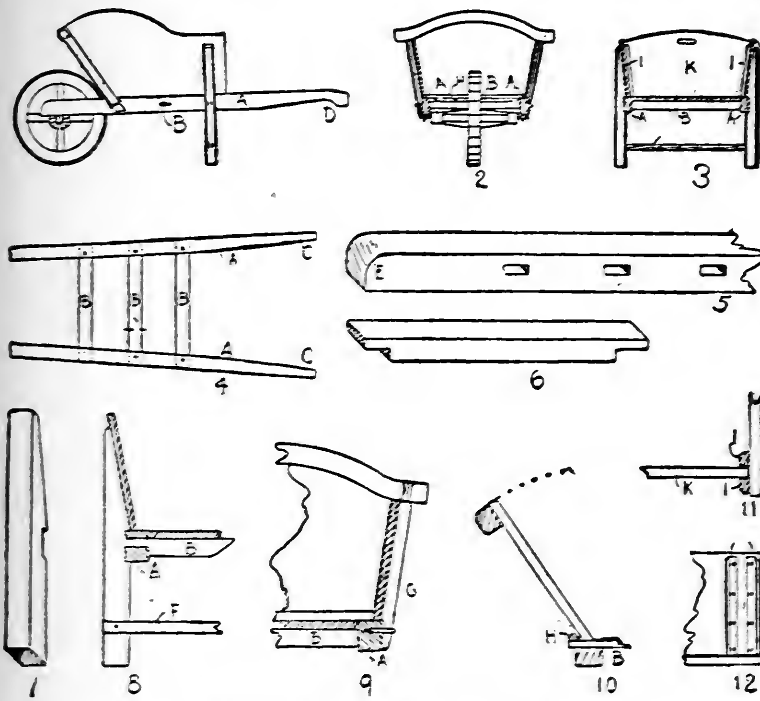


A STEERING GEAR.

like the larger one. It extends over the top edge of the wagon toward the inside and a block is placed under this projecting part. The drawing clearly shows this. The steering wheel is one taken from an old wagon, and the post it sets on is a broom handle. In Fig. 2, "n" indicates where nails are driven to prevent the post from working up and down. A piece of rope is tied fast to the lower end of the post and each free end is fastened to the axle. A twist of the wheel, either way, does the turning. It's a dandy little plan and will bring joy to the heart of the small boy.

HOW TO MAKE A WHEELBARROW

The wheelbarrow shown in the accompanying drawings and described below is not perhaps the easiest design to construct, as there is no doubt whatever that this advantage must be given to the box barrow, in which the body is made in the same way as a



ELEVATIONS AND DETAILS OF BARROW.

box, nailed together at the angles, the boards which form the sides being continued forward to form bearings for the wheel, and backward to serve as handles to drive the barrow by.

This method of construction, however, has so many disadvantages as to comfort in use and lasting qualities, that we have passed it over in favor of the more substantial, and easier to use,

framed barrow, the cost of which, as far as material is concerned, is very little more than the other, and the lasting qualities will probably work out in the proportion of about three to one, in favor of our choice.

The actual design of the framed barrows varies very much, a fact which may be seen in any neighborhood where barrows are plentiful, and it follows that the barrow which allows of a heavy load being carried comparatively easily is the one to choose, and this will be the one in which the body is well over the wheel, and where the front part is deep and the back part comparatively shallow, such as is shown in Fig. 1 herewith.

The framing should be of ash throughout, but the boards may be of deal, although elm is better, if available.

In addition to the side elevation in Fig. 1, we show elevations of the barrow from the front and back respectively in Figs. 2 and 3, and in Fig. 4 we proceed to the actual work of construction, and show the bottom frame complete. This consists of the two sides, A (five feet long, three inches wide, by two and one-half inches thick), and the three shutters, B (two inches wide by one and one-half inches thick).

The sides are mortised to receive the shutters, the tenons on the latter being "barefaced," that is, having shoulders at the under side only, as shown in Figs. 5 and 6.

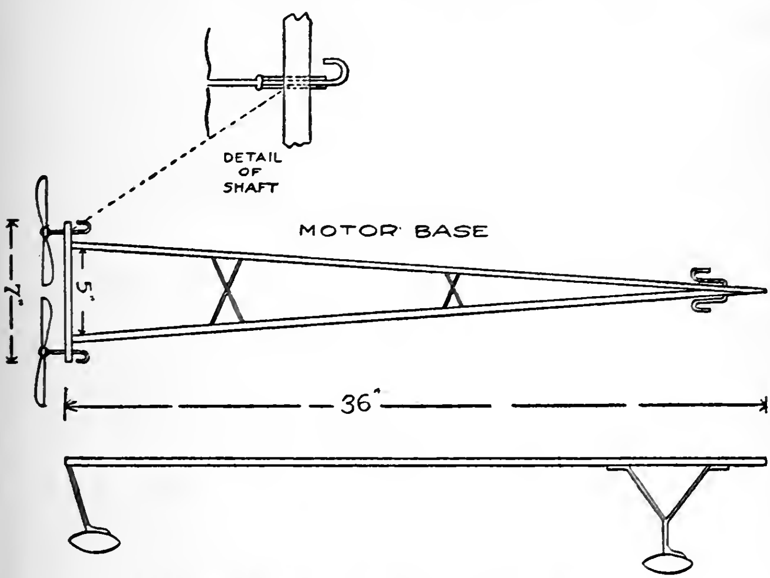
The complete frame is sixteen inches between the sides at the front end, and twenty-four inches at the back end, and the fact of this tapering as it does requires the shoulders of the tenons and the mortises to be cut at an angle to fit properly. To obtain the proper angle for these the sides should be laid out on the bench or floor, in the exact position they will occupy, the shutters being laid on them in their proper place, when it is easy to mark the right angles for the shoulders on the one, and the mortises on the other.

Before finally pinning together the framing, the handle ends of the sides should be reduced in thickness from the inside, as at C, Fig. 4, also shaped to form the handles as at D, Fig. 1, and the opposite ends rounded off on the top side, as at E, Fig. 5.

CHAPTER II

How to Build a Model Hydro-aeroplane

A SUCCESSFUL hydro-aeroplane which will actually rise from the surface of the water and sail aloft for a minute or more may be readily constructed. The materials required are cheap and easily obtained. The prize-winning models which hold the records for

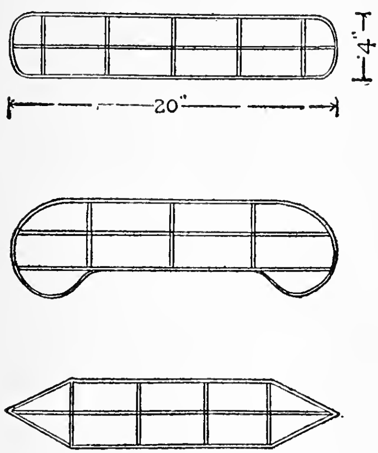


PLAN FOR FRAME OF A MODEL HYDRO-AEROPLANE.

high flying and duration have been built by boys fifteen years of age or less. Any bright boy with a turn for mechanics and a little patience may thus be the owner of one of these fascinating toys. The "hydro," as it is called, combines the fascination of model aeroplane flying with that of boating. The marvelous little toys

skim across the surface of the water as fast as one can run. By adjusting the planes or wings the models may be made to rise quickly from the surface and soar aloft, and on alighting right themselves and float like the proverbial duck.

A great deal depends upon the construction of the planes or wings of your aeroplane. Their exact form does not make so much difference, since a great variety of wings serve to carry a machine aloft. It is very important, however, that the planes be as light as possible, and at the same time strong enough to stand more or less knocking about without going to pieces. The builders of model aeroplanes have made remarkable progress in constructing light, durable planes. Practically all the model aeroplanes are alike in having two planes, with the larger one placed at the rear and the smaller one well forward.



TYPES OF PLANES.

The best material for constructing the frames of the wings is bamboo. It is extremely light and strong, and soft enough to be worked easily. The bamboo may be bought cheaply and may be sent through the mail at trifling expense. An old bamboo fishing pole or curtain rod will answer the purpose. The grain of the wood is so straight that it may be split into convenient strips. If you cannot find bamboo, a light rattan will answer, while excellent wings may be made of strips of any light straight-grained wood. In the following directions suggestions are given for several forms of planes, so that no boy need fail for lack of proper materials.

The larger plane of your model should measure about twenty inches in length by four inches in depth. The smaller plane should be about nine inches long by four inches or a trifle less. Let us begin with the larger plane. We will build this plane perfectly flat. In the early days of model aeroplane building great atten-

tion was paid to curving the wings slightly upward, on the theory that their lifting power was increased in this way. But so many models are flown with flat wings that it scarcely seems worth taking the additional trouble.

The simplest plan is to mark out on a sheet of stiff paper a plan twenty inches long and four inches wide, round the ends in a short oval, and build a frame or rim to fit. A long strip of bamboo about one-quarter of an inch square or a similar piece of reed or rattan is cut the proper length and soaked in water until it is soft enough to bend to the right shape. The rim may be built up of one or more such strips, the ends being glued or tied firmly together. When dry the frame will retain its shape. The frame may also be made with square corners by merely cutting strips the length of the sides and tying and gluing them together. It may be found necessary, in order to keep the frame rigid, to attach braces or ribs consisting of thin strips of bamboo. To make the joints secure tie them with strong thread and touch the threads with glue. The smaller wing is made in the same way, using somewhat lighter strips.

Some model builders prefer to have their main planes curved and the ends carried back as indicated in the accompanying drawings. To build these frames lay out the design full size on a board and construct the frame to fit this model. The pieces may be held in position by driving brads on either side of the strips to hold them in place. In case the sides must be shaped, soak the strips in water, bend them to fit the lines on the board, and tack them down in position. When dry the frame will be of the desired shape. It is best to begin with the simpler forms of planes. Before covering the planes, cut away the rough parts and sandpaper until the whole is perfectly smooth.

Great care should be taken to cover the planes smoothly. The easiest material to work is probably bamboo paper because of its toughness and lightness. Lay the frame of the wing on a sheet of paper and cut two pieces, leaving a margin of one-quarter of an inch all around.

Now dampen the paper by placing it between sheets of moistened blotting paper or cloth. The sheets are then stretched tightly over the frame and glued securely in position. Turn the edges over neatly and be sure that there are no wrinkles or creases. Both

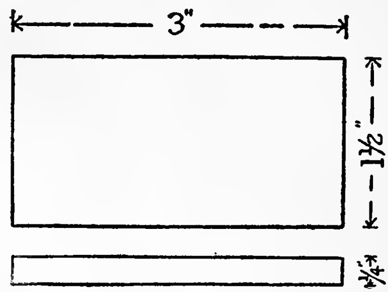
sides are covered in this way and the frame is set aside to dry. The paper will contract slightly in drying, leaving both sides of the wing smooth and taut as the head of a drum.

There are many other materials which make excellent coverings. A fine silk drawn tightly over the frame and sewed and glued in position makes a very attractive wing. The cloth must be closely woven, since a very thin material lets the air through and does not give proper support. It is a good plan to varnish the surface of the planes to make them air-tight. Some builders make the frames of wire and cover them with paper or silk. Still others use sheet celluloid. It is best to begin, however, with the simpler materials which are easiest to work, and experiment later when one has had more experience. Remember in building wings that the edges should be as narrow as possible to cut the air, as it were, and offer the least possible resistance.

It is well to leave the construction of the main frame of your hydro-aeroplane until the wings are constructed, since the experience in building these parts will be of value. The frame which supports the planes and motor consists of a triangle, lightly but strongly made, measuring three feet in length, and five inches in width. You will find bamboo an excellent material, as in the case of the wings, although a light straight wood will answer. Secure two strips of bamboo, or whatever material you use, measuring one-eighth of an inch by three-eighths of an inch and thirty-six inches in length. For the base you will need a stick three-eighths of an inch square and seven inches long.

These strips are to be formed into a triangle with a base of five inches. The base piece will, therefore, extend out one inch on either side. The two long sticks should be bevelled on one side at the end and glued and bound securely together. The triangle is completed by slightly mortising the base piece and the ends of the sides to form neat joints and gluing and binding them together. The frame will be found very light, and should be braced by three cross-pieces. Use a thin strip of bamboo or other light wood and glue and tie it to the sides to brace it. These may be run straight across parallel to the base or diagonally. Be careful to finish the frame as neatly as possible. The whole should be sandpapered and painted with a thin varnish. Bear in mind that a smooth surface offers less resistance to the air.

Now is as good a time as any to attach the floats to the frame. There are a great many forms of floats, but a very simple design will answer best. Using a thin strip of bamboo, of one-sixteenth of an inch or less, attach two pieces to form the letter Y, the fork being four inches in length and the lower part six inches in length. The pieces should be glued and tied in position. Prepare three such parts. Now soak the ends of the pieces in water until they are pliable. The two upper sections of the Y are then turned back at a point one inch from the end, while the longer end is bent at right angles. Now fasten the upper ends of the Y to the base of the frame with glue and thread, exactly at the center. The other two should be fastened one to either side of the frame and about four inches from the front of the frame.



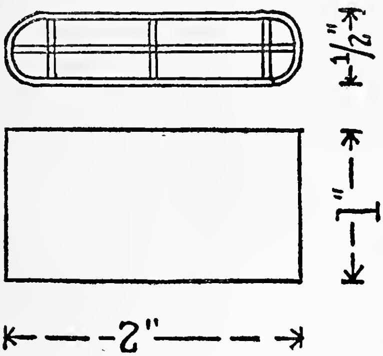
FLAT PONTOON.

The floats or pontoons on which the hydro-aeroplane rests are very simple. Some builders use small blocks of wood measuring one and one-half by three inches, with a thickness of one-quarter of an inch. Another plan is to construct two ovals of thin strips of bamboo two inches long and half an inch across, connect the two by cross-pieces at the ends and sides, and cover the frame with oiled silk well varnished. The form of the pontoons does not much matter as long as they are light and buoyant. The pontoons are then fastened to the skids, two forward and one at the rear, of the frame. The shape of the skid makes no difference, but it is essential that the pontoons be fastened rigidly. The front pontoon should be attached with longer supports, so that the model when resting on the water will slant slightly upward. After completing the skids set them aside and install the motor before attaching them.

The motor is one of the most interesting details of the model "hydro." There have been countless experiments to devise some motive power light and efficient enough to drive these delicate machines. Nothing has been discovered, however, to com-

pare with the rubber-strand motor. This consists merely of a number of strands of rubber running from end to end of the motor base, which when twisted tightly unwind, driving the propellers at high speed.

To install the motor, first place two hooks on either side of the apex of the frame. Secure a stout wire which will hold its shape and drill a hole through the frame one inch from the end and pass the wire through it. Now bend back the wire on both sides and shape the ends into two hooks wide enough to hold the strands of rubber forming the motor. The sides of the hooks should be bound tightly to the frame with strong twine and touched with glue. To construct the motor itself, you will require about twenty strips of rubber forty inches in length. Some builders use strip rubber, while others prefer a strand one-sixteenth of an inch square. This rubber may be obtained from the dealers in such supplies at a cost of one cent a foot. This is the chief item of expense in building a model hydro-aeroplane. It is important that the best rubber be secured.



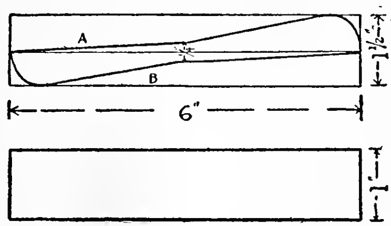
ELLIPTICAL PONTOON.

Cut the rubber into twenty lengths each forty inches in length. Now gather the ends of ten strands and bind them tightly together with a strong thread. Next take a piece of the wire and bend it to form a double hook about one inch in length, and securely fasten the end of the strands to one end. Fasten similar hooks to both ends of the two groups of strands. The rubber may thus be hooked to the frame or the propeller shafts readily. You cannot be too careful of the rubber. When not in use keep it in a dry, cool place.

The shaft of the propellers will turn in the base of the frame just outside the triangle. It is a good plan to buy these shafts ready made, since they cost but a few cents and may be purchased at any of the model aeroplane supply houses. The ready-made parts will be lighter and truer than any you can make, but they are not

essential. In case you buy these parts, drill a hole in the end of the base half an inch from the ends just large enough to hold the metal securely and drive and wedge it firmly in place, using a little glue if necessary. If you are working without these parts, secure a piece of steel wire—a large hat pin or an old bicycle spoke will answer—and a piece of tubing just large enough for it to turn freely. Cut the tube into two one-half-inch lengths, drill holes of the same diameter in the base stick, pass them through it, and fasten them securely in position.

The model is now ready for the propellers. We have left these until the last because they require more skill than any other detail of the aeroplane, and the experience gained thus far will be needed in their construction. The beginner will do well to purchase his propellers ready made. It is very important that they



PROPELLER BLOCK.

be carved skilfully with just the right angles. They may be bought cheaply, ready mounted. Even if you intend to make your own propellers it will be well to purchase a pair to use as models. Another plan is to buy propeller blocks for a few cents each and whittle out the propellers from these.

In case you prefer to make the propellers yourself, however, the following instructions will enable you to build an efficient pair, and with practice you can make them quite as well as the regular manufacturers. Prepare two blocks of some light, straight-grained wood, measuring six inches in length, one and one-half inch in width and one inch in thickness. Mark the center of each side and draw two lines on the upper face bisecting the block. At the center draw a circle with a diameter of one-quarter of an inch. With a sharp knife cut away one edge (A) and the opposite edge on the lower side (B) until a blade a trifle less than one-eighth of

an inch has been formed. Next cut away the other end of the block beginning with the opposite side, so that the blades will be at an angle of about forty-five degrees. Cut away to the circle at the center. The outer edges should be rounded off and the whole sandpapered and varnished. The axle should be passed through the hub at the center and fixed firmly in position. Now pass the axle through the tube in the base stick and bend the wire into a hook to hold the end of the rubber strands.

To wind the motors and store energy for the flight, attach the rubber strands to the hook at the end of the base and turn the propellers. It will be found much more convenient to secure a winder, which is designed something like an egg beater, so that one turn will twist the rubber half a dozen or more times. If you use a winder the turning is done from the front end. The rubber strands are unhooked and hooked on the winder and replaced on the hook when wound up. The motors must be wound in opposite directions. Turn the rubber until a double row of knots is formed. You will soon find by actual experiment how many turns the motor should have to get the best results.

To set up the machine place the larger plane about two inches from the base and tie it in position with a single strand of rubber. The smaller plane should be fastened about three inches from the front end in the same way. Much depends upon the position of the planes, and they must be moved backward and forward until they are in the proper position. It may be found necessary to tilt the planes slightly upward by inserting blocks of wood under the forward edges to give the machine the proper lift. It is impossible to lay down any hard-and-fast rules for the position of the wings.

To fly the hydro-aeroplane wind up both motors in opposite directions, and, holding the propellers with one hand, place the machine carefully on the water and let go. When properly adjusted the machine will dart forward and, after gliding over the surface of the water, will begin to rise slowly. Once free of the water, it should climb rapidly and sail through the air until its motors are run down.

CHAPTER III

How to Build a Good Model Aeroplane

A MACHINE THAT WILL FLY ONE THOUSAND FEET

Do you know how many fellows in this country, alone, are making and flying model aeroplanes? Their numbers run up into the thousands already. How many of you have seen a good flying model or been to a meet where several of these little flyers were in the air at once? It is great sport to watch a well-made model "take to the air." Some will rise and circle gracefully around, avoiding obstructions as if they had minds of their own, and again they will go headlong into the topmost branches of a tree, which means a climb after them. But generally the model will rise and get away in a fine undulating flight, with its owner doing some cross-country sprinting in trying to keep up with it.

At a recent contest a model built by a boy rose to a great height by gradually ascending circles, until it was completely out of sight, remaining aloft ninety-one seconds. The one described here has made flights of from 1000 to 1400 feet in a "straight away" and remained in the air three-quarters of a minute.

The first thing to consider in making this model is what materials are needed. Here they are:

1. Six feet of flat oiled steel wire, for framework of planes and ribs;

2. One sheet of bamboo fibre paper, for covering planes;

3. Two straight-grained spruce sticks three feet long by $\frac{1}{4}$x$\frac{5}{16}$", for fuselage;

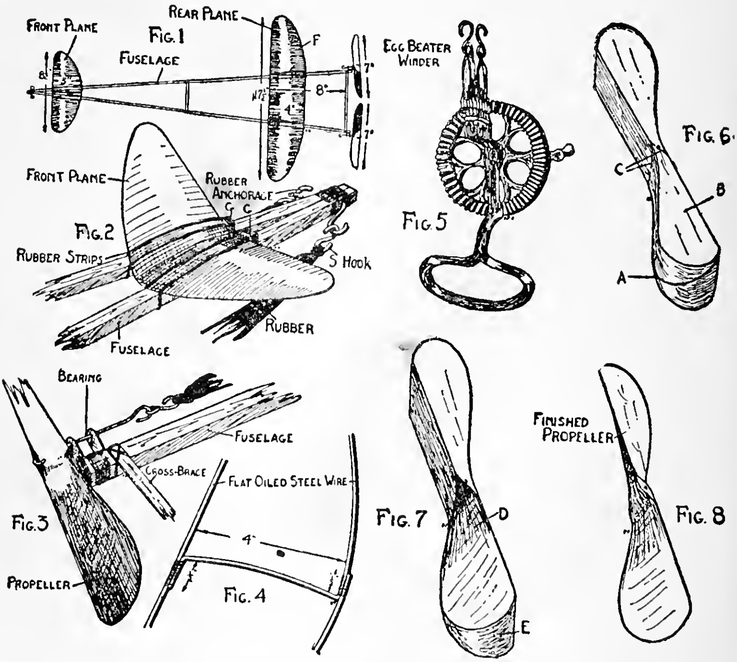
4. Two feet of split bamboo, for cross braces;

5. Three feet of one-sixteenth inch steel wire, for hooks, etc.;

6. Two seven-inch propeller blanks, for propellers;

7. Forty-two feet of three-thirty-second inch square rubber, for motors;

8. One egg beater, for winder;
9. One can of glue, for joints;
10. One spool of strong linen thread, for lashing joints;
11. One can of bamboo varnish, for coating planes;
12. One four-inch piece of brass, for bearings;
13. One-half dozen washers, for bearings.



PLANS FOR A MODEL AEROPLANE.

The main frame or fuselage is triangular in shape and is made of straight-grained spruce, each side or member being thirty-five inches long by $\frac{5}{16}$x$\frac{1}{4}$''. One end of each stick is tapered off on the inside, to form an acute angle when fastened together, which is done by gluing and lashing with thread as shown in Fig. 2. The other ends are braced six and one-half inches apart by a piece of bamboo fastened on top of the fuselage by lashing with thread and

gluing one-half inch from the rear end of each member of the fuselage. The middle cross-brace is also of bamboo and is fastened in the same way as was the rear brace, on top of the fuselage midway between the ends as shown in Fig. 1. Now two blocks (GG) are cut to form steps and are glued and lashed tightly with thread to the top of the fuselage with the flat sides of the blocks on the sticks, three and one-half inches from the apex (front end). These blocks are for elevating or depressing the front plane. The object of this is explained in the section on Front Plane.

Bore a hole about one-sixteenth inch through the frame from side to side one-half inch from the apex. A piece of one-sixteenth-inch wire, 3 inches long, is inserted and each end bent into a hook to receive the S hooks of the rubber motors as shown in Fig. 2.

These can be made or bought. To make, get a piece of three-sixty-fourths-inch brass five-sixteenths-inch wide and four inches long. This is enough to make two propeller hangers and should be cut in half and bent with pliers to form two U-shaped pieces (see drawing Fig. 3). Or use the same amount of flat metal that you will cut off in making your winder described later on. Now bore a one-sixteenth-inch hole through the ends so that the propeller shafts will turn easily. These are glued and lashed to the rear ends of the fuselage with the ends of the U extending out from the frame as shown in Fig. 3. For the shafts use two pieces of wire three and one-half inches long, the same size as the holes, and with pliers bend a hook at one end of each wire to support the rubber motors. Push the shafts through the holes in the brass hangers with the hooked ends toward the front of the fuselage; place a small bead and washer on the disengaged end of the wire shaft. Next slip the propellers on the shafts, with the curved edges of the blades leading. In revolving they should turn out in opposite directions. The straight ends of the shafts are bent back over the propellers to keep them from turning on their shafts. To cut the propellers refer to section on Propellers.

The frame of the plane F is made of wire; the best to use is a flat oiled steel, which will stay bent. A piece 43 inches long is required; it is bent with pliers to the shape shown in Fig. 1, and the ends lapped one-half inch and fastened by gluing and lashing them four and one-half inches from one end of the wire. This four and one-half inch end is used as a brace or rib; and should cross the

plane frame six inches from one end of the frame. It is held by gluing and lashing it to the opposite side of the frame, as shown in Fig. 4. A corresponding rib, five inches long, with each end bent one-half inch, is fastened in the same way to each side of the frame or rim six inches from the other end. After the frame is finished, with pliers bend the front middle portions of the rib slightly upward (about one-half inch) as shown in Fig. 4. This is to give what is known as camber and increases the lifting power and stability of the flyer considerably. The tips of the plane frame are also bent up slightly, about 30 degrees, to keep the model steady in flight.

Use light, strong paper; bamboo fibre paper is the best. Lay the wire frame upside down on the paper and cut around the frame, allowing about one-quarter inch for turning over. The paper is glued along the edges and turned back over the rim of the plane frame; be sure that it sticks fast. Care must be taken to get the paper as tight as possible, as wrinkled surfaces hinder the flying qualities. The plane is now ready to be painted or sized with a thin varnish; bamboo varnish is the best, spreading it evenly over the paper. This tends to shrink and tighten the fibre, and forms an airtight, strong surface that will give great sustaining power.

This small plane is sometimes called the elevating plane, as by raising or lowering it regulates the upward and downward movement of the model in flight. It is made of the same material and like the main plane, with the exception that it is bent up at the ends to form a dihedral angle of about 45 degrees, as shown in Fig. 2. This plane has only one rib and is covered with the paper on the underside instead of on the top. The wire for the rim and single rib is twenty-four inches long and bent, and the rib formed in the way described.

The small plane is fastened on top of the fuselage three inches from the apex, with its straight front edge over the blocks GG, by wrapping with a strip of rubber tightly around the plane and frame, first over the plane and then under the fuselage as shown in Fig. 2. The main (rear) plane is fastened on top of the fuselage in a similar way, with its straight front edge eight inches from the rear brace of the fuselage.

Make four S hooks from a piece of one-sixteenth-inch wire and hook them on the front rubber anchorage and propeller shafts to

hold the rubber. About forty-two feet of three-thirty-seconds-inch square rubber are needed; twenty-one feet for each motor. Make a loop in both ends of each portion of rubber and hook one over the front S hook, then pass the rubber around through the S hook at the rear, back and forth, until the second loop is slipped on a hook. Do the same with the other rubber motor.

There are two propellers for this flyer, one a right-hand and the other a left-hand propeller. A right-hand propeller is one of which the uppermost blade turns toward the right as the propeller revolves in traveling forward. Of course, a left-hand propeller turns in the opposite direction.

In making a propeller the best way is to buy what is known as "blanks," which can be had from almost any supply dealer. It is then cut into shape with a knife, which would be a good deal easier than cutting the blank first out of a block of wood.

In making a right-hand propeller, draw a curved diagonal line at each end of the blank at opposite angles as shown in A, Fig. 6. To carve, hold the blank in the left hand, cut the portion B out, starting at the dotted line C, as shown in Fig. 6, so that the blades will be concave, *i. e.*, curved in as shown in D, Fig. 7. The blank is then turned over and the portion E, Fig. 7, is cut to follow the other side. Care must be taken, however, not to get the blade so thin as to weaken it. Observe carefully in the drawing how the propeller is shaped at the middle for a hub. It is at this point the full thickness of the blank. The same process is used for the other blade of the propeller. The leading edge is always the curved edge.

When the four sides are finished, sandpaper the surfaces until they are perfectly smooth. The propeller should now look like Fig. 8.

To make a left-hand propeller, the curved diagonal line at the beginning is drawn at an opposite angle, and the opposite cutting operation is carried out.

It would take altogether too long to wind up the rubber motors by turning the propellers. One of the best ways to accomplish the winding is to make a winder from an egg beater, which is shown in Fig. 5, although a better one can be made from a hand drill. The two beaters, of flat metal, are each clipped three inches from the gear wheels on one side and one and three-quarters inch on the

other. Then slip in the gear wheels with the attached pieces of metal down on the heavy wire on which they revolve and cut the wire off three-quarters inch from the cast iron bracket to which the ends of the wire are bound.

Now put the gear wheels and the attached metal extensions back on these three-quarters-inch wire stubs, and hold them there by soldering on a piece of brass tubing that will just fit on the wire stub or axle, moderately close to the gear wheels. Now bend the flat extensions on a line with the wire stubs, so that the tips of the extensions will meet; the extra one-quarter inch of flat metal on one side is turned over on the other shorter end, and through these three thicknesses of metal a one-sixteenth-inch hole is bored. Make two S hooks out of a three-inch piece of one-sixteenth-inch wire (same as used for the S hooks of the rubber motors). Insert a hook of the S in the one-sixteenth-inch hole and pinch it together with pliers, to keep the hook tightly in place. The winder now looks like Fig. 5. Both rubbers can be wound up at the same time by hooking them on the hooks of the winder; one turn of the large wheel means five turns of the rubber.

Put a little oil on the bearings so that the propellers will turn easily.

Have some one hold the model at the rear by the propellers and fuselage. Unhook the S hooks with the attached rubber from the front rubber anchorage and hook them on the winder, step back until you have stretched the rubber about twice the length of the machine, and wind it up about 100 turns *of the winder* for a trial flight. Then hook it back on the front rubber anchorage.

Grasp the rear cross-brace with the right hand in such a way as to prevent the propellers from unwinding, supporting the flyer by the middle cross-brace with the left hand. Push the flyer forward through the air, letting go with both hands at the same time.

Longer flights can be made by winding the rubber up a greater number of turns; *250 turns of the winder* is the limit.

Be patient if things don't go just right; keep trying; you will succeed.

CHAPTER IV

Two Very Simple Model Aeroplanes

MODEL NUMBER ONE

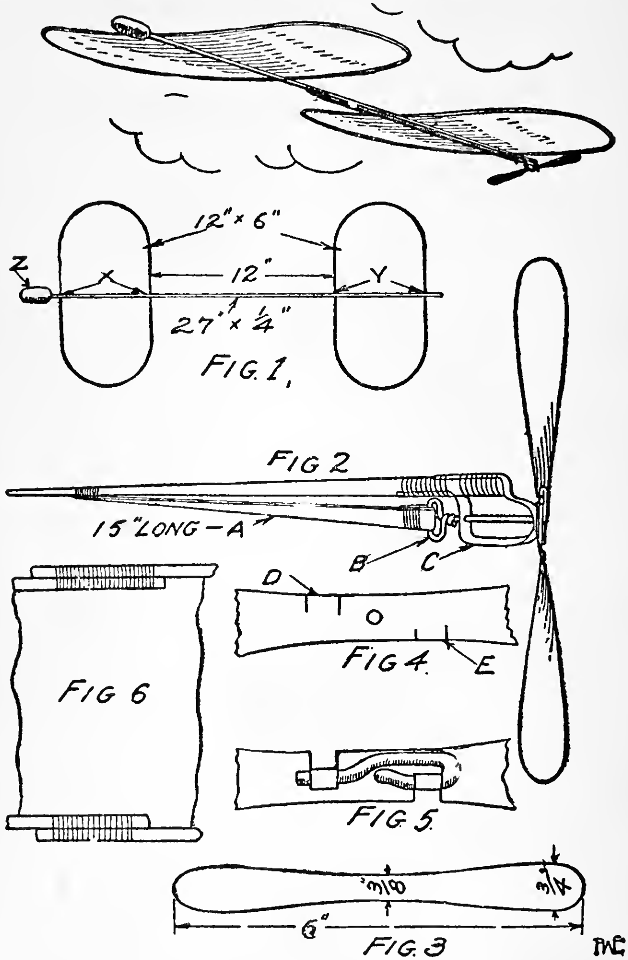
THE principles of flying are really simple when understood, and the wonder is that they were not discovered long ago. We always knew that a large piece of paper, or any flat object of considerable area, would present so much surface to the air, if kept in a horizontal position, that it could not fall rapidly. The trick was to make one or more flat surfaces or planes, as they are now called, and balance them so nicely that they would maintain their position parallel to the ground. The Wright brothers accomplished this in some of their earlier models, and were able to glide slowly down from hills, sometimes alighting a half-mile from the starting point. Thus encouraged beyond their fondest hopes, they went further and added devices to their machine that enabled them to tilt the wings or planes to any desired angle, retarding the downward motion at will.

As a boat is forced through the water by the screw wheel in the rear, so an air craft may be made to move forward by a similar propeller. The only thing that remained was to provide some force to drive the propeller that would be light enough to be practical. The Wright brothers searched about until they found an engine light enough for their purpose, and their efforts to fly soon became successful.

The toy pictured here depends for its buoyancy on the same principles that govern all successful aeroplanes. The planes prevent it from falling quickly, the wheel drives it.

First get the long stick or spine. It should be one-quarter inch square and must be light and straight grained. There is nothing better for the purpose than a piece of white or cork pine. Each plane is twelve inches long and six inches wide. To make them

you will need four pieces of rattan each twenty inches long. You can get it at factories where baby carriages and reed chairs are



PLAN FOR MODEL AEROPLANE, NO. 1.

manufactured or you can obtain some from an old piece of furniture. To make one plane you use two pieces bent to a U shape

and fastened together at the ends by wrapping with thread, as shown in Fig. 6. Nail the planes to the twenty-seven-inch stick with small brads. The planes are covered with light cloth. It may be stitched on or glued. Pull it tight enough to make the planes curve slightly upward at the ends. To the rear end of the spine we now attach a strip of tin bent and fixed on, as shown in "C," Fig. 2. Next cut a strip of tin to the shape and size of Fig. 3. Slit it as shown in "D" and "E" in Fig. 4, bending over to make fast to the wire key as in Fig. 5. The rubber band "A" in Fig. 2 is fastened to the wire "B" in Fig. 2. This cut shows the whole arrangement very clearly. As might be expected, the end that has the fixtures on will be considerably heavier than the other, so to balance up we put a spool or knob on the fore end. The best way to do this is to put a common spool on, and if it proves too light, wrap wire around it until the aeroplane will balance nicely when suspended from the ceiling with a thread tied to the center.

To use the toy, you twist the wheel around until you have it as tight as the rubber band will stand and then toss it into the air, releasing the tension at the same time. It will ascend to a good height and then glide gracefully to the ground.

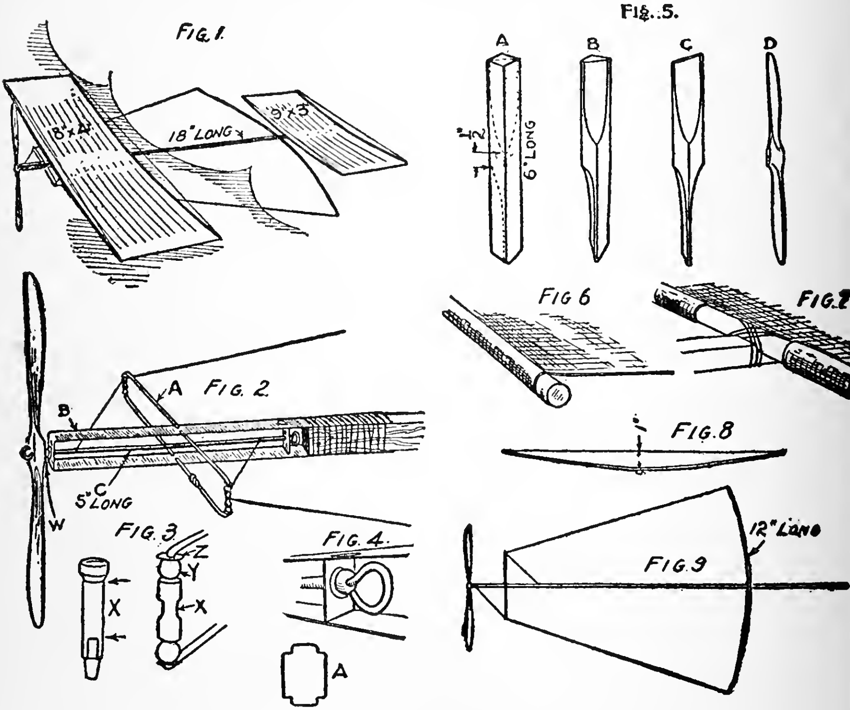
MODEL NUMBER TWO

This article shows how to make a complete monoplane model, using as power a bow and string which has been drawn tight by twisting the wheel. Upon being released it gives a powerful impetus to the wheel. The idea is a brand new one and marks the beginning of a new kind of toy flyer.

First get a stick one-quarter inch square and eighteen inches long. It must be sound and straight grained. Spruce or ash being favorite woods, the main point is to have the backbone light and strong. Put on a piece of hickory or any flexible piece for the bow at about the position shown. The exact distance is best determined by experimenting. Fasten it with wire so that it may be moved till you get the right balance. The plane is made of silk stretched on a rattan frame 18 x 4″. It is curved up by putting tight strings parallel with each other from corner to corner. The amount of curvature (one inch) is shown by Fig. 8. The small plane (9 x 3″) is made in the same way. Its mission is something like that of the

tail of a kite. Figure 5 gives a clear idea of cutting a square spruce stick into propeller shape. The planes are fastened to the backbone or spine in the manner shown in Fig. 7. Use very fine wire or strong thread for the lashing. Now comes the power plant.

Bend a long strip of tin double and tack or tie it to the long stick or spine as shown in Fig. 2. Close to the end of the stick place the



PLAN FOR MODEL AEROPLANE, NO. 2.

small piece "A." (See Fig. 4 for complete view.) For a shaft we use a bicycle spoke. For the cross-arms "A" in Fig. 2 use two spokes threaded through slits in the tin and twisted together. The little piece "X" is found on spokes, and used to tighten them. Get two of those and place one on each side of the cross arm, to be used as pulleys. It is well illustrated in Fig. 3. "Y," in this same

cut, is a bead used for a bearing. It is a simple thing to understand, but you must work carefully and slowly to get right results. Look the drawing over carefully and study the details. Everything is shown and it will answer any question that might come to your mind.

A bearing is that part of a machine that comes in contact with any other part that turns or moves. Always try to make those parts slippery by using oil, and to further reduce the friction use a bead, in this case at "W," in Fig. 2. Now put your wheel on, use strong fishline for a bow string, simply tying it on; bring each end over a different pulley on the sides of the cross-arms "A" in Fig. 2. Twist the propeller until the bow is drawn as much as it will stand, then toss the aeroplane gently up. It should fly fifty or sixty feet at least, and is not liable to be broken, for the planes will cause it to glide safely to the ground even after the power is spent. The greatest difficulty you will have to overcome is to balance the device properly to make it light enough.

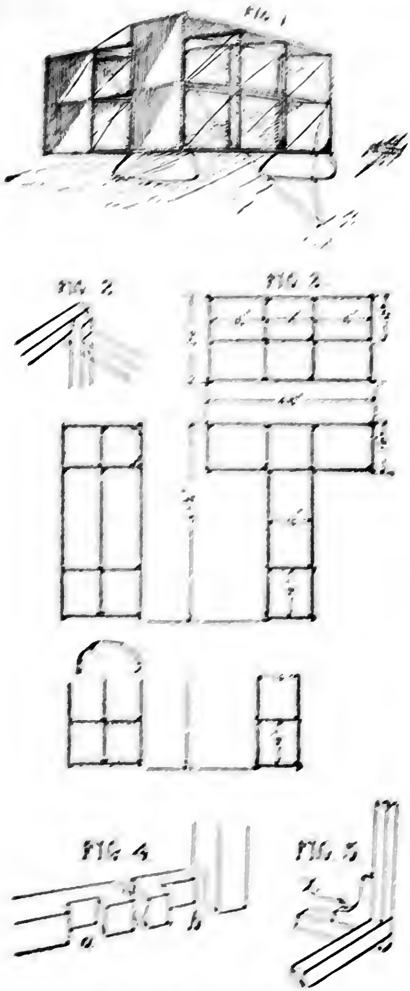
CHAPTER V

Kites

A LARGE PLANE KITE

KITE flying, although the oldest form of scientific amusement, seems to be entering a new era of development. Perhaps it is because of the intense interest which attaches to anything in the way of aerial navigation, accentuated by the late successes of aviators both here and abroad. At any rate, new kite models are appearing every day, and not only boys, but men whose names are high on the scroll of fame are the inventors.

The wood used for the framework was straight grained laths planed on all sides. For the main beams of the front section and the top and bottom of the rear section the laths were ripped in two; for the uprights and connecting pieces they were cut in three pieces lengthwise. Begin by making the main section, Fig. 3, which is composed of three planes. Eight sticks two feet long are used for uprights, and six sticks four feet long for the main beams. They are nailed together with small brads. The corner joint is shown at Fig. 2. The two ends are made first, using two sticks two feet long and two fourteen inches long. Connect these by the four four-foot beams. This gives the framework for the top and bottom planes. Then halfway between the two the middle one is built in. Now sixteen inches from the ends of each plane the uprights are fastened. This is clearly shown by the diagram, Fig. 3. The wire skids shown in the picture to protect the kite in running to fly it or in landing should be put in now. For the rear section we use six pieces fifty-seven and one-half inches long, four pieces two feet long, and six pieces fourteen inches long. As laths are only forty-eight inches long, they will have to be spliced by overlapping and nailing. The back end should be framed first as in the case of the main section. The dimensions are given and the manner of joining



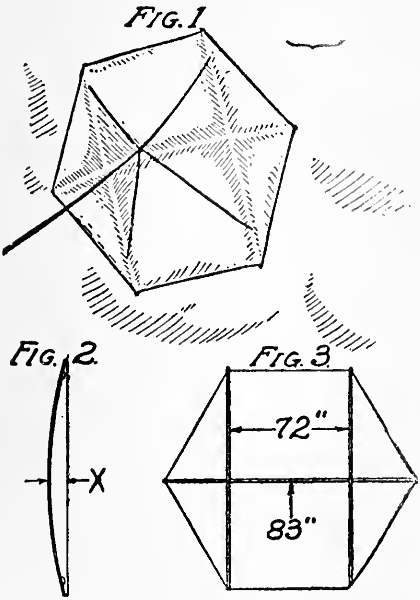
[illegible]

is the same as for the part already described. When the rear section is built it must be attached to the front section. When they have been joined, each cell or square is covered with fine wire lac-

tened from corner to corner. For a covering use strong muslin. It is laced and sewed on, first the middle planes and then the outside. The bridle cord is fastened to the ends of the middle cord. Where the strings come together should be a distance of three feet from the frame. For flying the kite strong fish-line is required. You will be repaid many fold for the labor of making it when you see it up in the air like a real aeroplane and feel the mighty tug at the cord. The kite, though large, is simple, serviceable, and efficient.

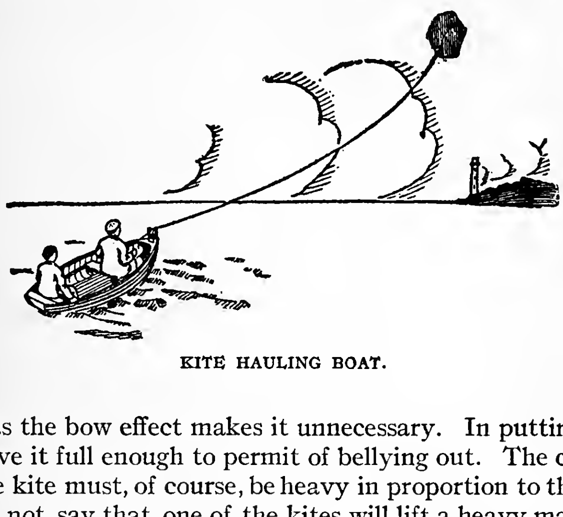
A MAN-LIFTING KITE

Of late years so much experimenting with kites has been done by earnest investigators that new types and models appear almost every day. In reality, nearly all of those models are closely related to the common type of flat paper kite known to every boy in the world. However, more skill has been used in keeping down the weight and increasing the pulling power, and in some instances kites have been made so strong that they would lift a man off the ground. In this article is described one of those giant models with tremendous lifting power. Only three sticks are used, but these must be of the best quality. Spruce is a good wood on account of its being light and tough, but no doubt you will be able to find as good material, if you can't get spruce. Be sure your sticks are straight grained and a trifle heavier in the middle than at the ends.



MAN-LIFTING KITE.

Material one-half inch square is good, but I have a leaning for pieces one and one-half inches wide and one-half inch thick. The latter are heavier, and that, for a beginner, is one bad disadvantage. Where the sticks cross each other they may be fastened together with two brads or by tying with thread. The long single stick is bowed by stretching a stout cord from end to end, as is shown in Fig. 2. The belly band, or bridle cord, as it is called by the wise ones, is put in as indicated by Fig. 1. The tying should be done at a distance of about ten inches from the points. The kite is covered with fine meshed cloth. Light muslin, drilling, or Japanese silk are used a good deal for this purpose, but I would advise you to get the first mentioned, as it is the cheapest. The kite has



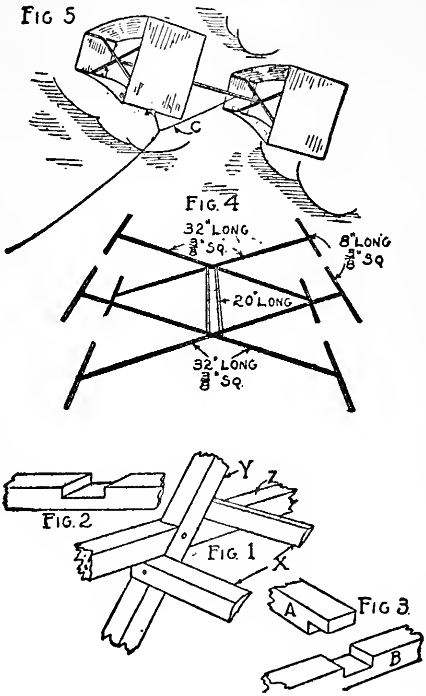
KITE HAULING BOAT.

no tail, as the bow effect makes it unnecessary. In putting on the cloth leave it full enough to permit of bellying out. The cord used to fly the kite must, of course, be heavy in proportion to the rest of it. I do not say that one of the kites will lift a heavy man off the ground, but I have seen three or four on a single line do so.

Some day when you go rowing put one of those big fellows up and tie the end of the line to the bow of the boat. If there is any kind of a stiff breeze it will pull you along, but, of course, getting back is a different thing. It may be tried on an ice-boat and will no doubt be able to send you gliding along. You should put some kind of reel on your boat. A simple one can be made by placing a spool between two upright posts.

A BOX KITE

Here is a box kite that is framed in quite a new way. It is not as strong as the regular four-sided frame, but it has the advantage of lightness, and is so constructed that the strength is where the strain comes most. It will fly well, but must be handled carefully



A BOX KITE.

while on the ground. To have success in kite flying you must understand something about the principles of aeronautics. A kite or an aeroplane floats on the same principle that a boat does. The air is a medium that has density and weight just like water, but, of course, not so great. The planes or flat surfaces of this kite rest upon the air and are supported by it. The ascent of a kite of

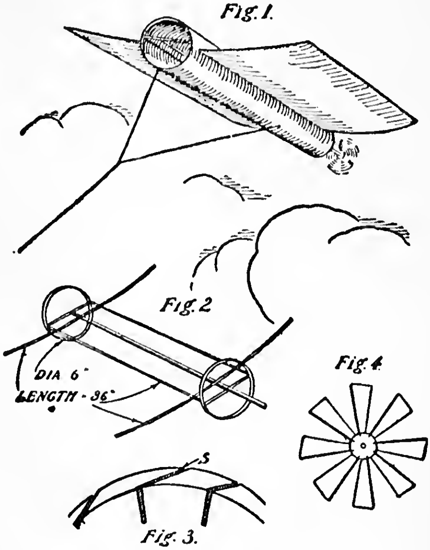
this type is due to the tilting upward of the fore part of it. If it were held parallel to the earth it would not go up. In the upper air there are strata or layers. Some have more density than others, and when the plane strikes one of those it may be easily pulled up this hill of air just as you would pull a sled up a more solid incline.

The central cut shows the framework of this kite so clearly that a lengthy explanation would be quite superfluous. In the detail drawings you may see how the joining is done. In Fig. 1 "Y" and "Z" are the thirty-two-inch sticks, "X" represents the twenty-inch pieces. Spruce or pine are the choice of materials, but anything will do in a pinch. Lightness and toughness are the qualities to look for. The sticks would be better to be one-quarter inch square, but of the lighter woods they may be one-half inch square. Figure 2 shows the notch cut in each long stick where they join each other to make the X-shaped end. The cross-sticks on the ends of the thirty-two-inch pieces are also notched as shown in the detail Fig. 3. Glue all joints and also secure them with small brads. The covering is of light muslin. When it is lashed on it will materially strengthen the frame. There is no certain way of attaching a bridle cord other than to be sure that "C" is longer than the other string so that the kite will tilt slightly upward. Rub linseed oil on the sticks and it will preserve them against splits and warping.

A TUBULAR KITE

Here is something quite new and different in the kite line. The type of kite shown here has been tested and found effective. The first thing to make is a rectangular frame 36 x 6″. It is made of quarter-inch spruce or any tough wood. The pieces are fastened together with small brads taken from a cigar box. In the center of this rectangle place another stick forty inches long. Now you want a light hoop for each end. The kind your mother uses for fancy work will be just the thing. They can be purchased for a nickel a pair. The cross-pieces, slightly bowed, are next tacked on. The joints may be reinforced by wrapping with waxed thread. The covering may be either cloth or paper. Make a tube of Japanese silk by sewing the edges of a piece one yard long and a trifle over a half yard wide together. Slip it over the rings before you

put the cross-pieces on. It should fit tightly. The ends a few inches back are not sewed until the thirty-six-inch cross-pieces are on. The pieces mentioned are secured in place, then the tube may be finished to the ends and fastened to the hoops by stitching through holes punched in the hoops or bored with a gimlet. The side wings are too simple to need any explanation. The bridle cord is attached to the central stick. The string used for it may be passed through the cloth by using a needle. The purpose of a bridle cord is to give

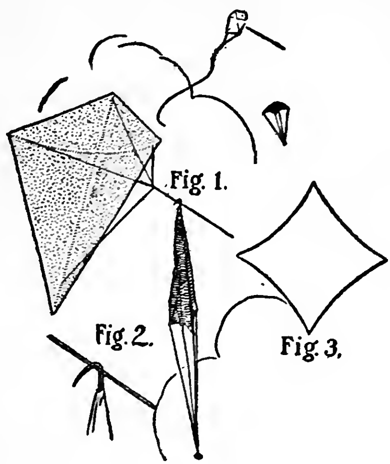


A TUBULAR KITE.

the kite a tilt. The fore end must be the highest always. An angle of 45 degrees is right for this kite. The long center stick is also used as a bearing for the propeller in the rear. The propeller is made of a light pine block four inches in diameter and a half inch thick. Slant cuts to the depth of an inch are made with a saw as shown in Fig. 3. Into these cuts blades made of basket wood or cardboard are glued. Bore a gimlet hole in the wooden disk and for a shaft use a nail that fits loosely and is tightly imbedded in the long stick. The kite is now ready for a trial.

KITE PARACHUTE

Kite flying in itself is great fun, but when you can add something to the simple pleasure of seeing your kite soar high above your head and tug at the string you hold in your fingers, you will find a fresh delight in the pastime. Of course, you have seen balloon ascensions and parachute drops. Well, why not add the parachute



KITE PARACHUTE.

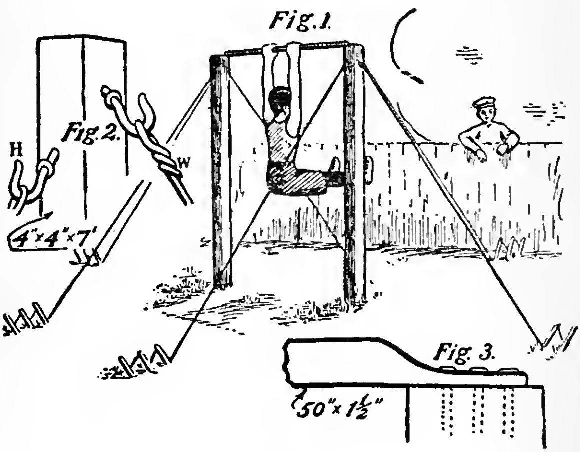
feature to your kite? It can be done very easily if you will study the following directions:

Get a piece of tissue paper or cloth shaped like Fig. 3. Tie a cord twenty inches long to each corner and bring them together at the lower ends, at which point a light weight, such as a piece of corncob, is tied. Pierce the center of the cloth with a pin and bend it over the string as shown in Fig. 2. When the wind has carried the parachute to a good height a slight jerk will release it.

CHAPTER VI

An Outdoor Gymnasium

Every boy likes to have at his disposal gymnastic apparatus. There are printed here, therefore, several simple devices that can be erected in your yard at very little expense. The first is an old-fashioned turning pole, called nowadays a horizontal bar. The main part consists of two stout posts sunk into the ground. The height over the surface will depend upon your stature. The bar



A HORIZONTAL BAR.

should be about six inches higher than you can reach. To make the posts solid and firm we brace them from three sides, as shown in the cut. Figure 2 shows how the wire is fastened to the hooks. The low end of the wire is fastened to a stake driven into the ground at an angle. This stake is reinforced by another directly behind it, and for greater strength a third stake may be driven. This is the idea of a boy correspondent and is good. If you adopt this means

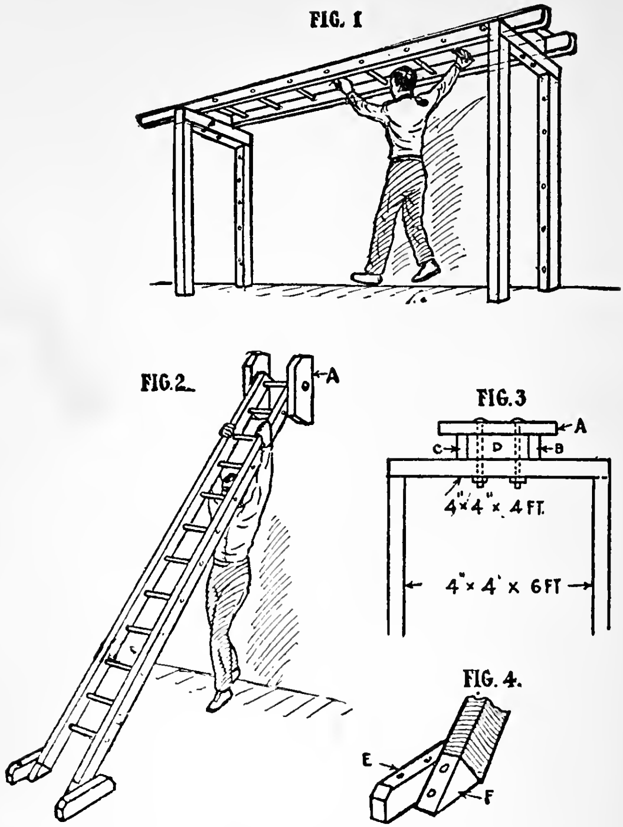
of bracing the supports it will not be necessary to sink them more than a foot, but the wire stays may be eliminated and a neater job effected by sinking the posts three feet in concrete. Use the 1-2-3 mixture, that is, one part cement, two of sand, and three of stone. For a bar at the top you can use a piece of pipe with the ends hammered down and bored for bolts as shown in Fig. 3. Any blacksmith will do this work for you at a slight cost or you can do it yourself. Heat the end of the pipe in a coal fire till it sputters and glows red, then, grasping it with something to shield your hand from the heat, you can hammer it flat and punch holes in it with a spike. If you prefer you can use a piece of hardwood of the same shape for the bar. Put one of those up in your back yard and practice chinning yourself. It never gets out of order and will last a lifetime.

GYMNASIUM LADDER

You can have a good deal of fun with a ladder and incidentally get some good exercise by following the hints contained in the following article. Figure 1 shows an arrangement which makes a fair substitute for the Spanish rings. The boy swings from one rung to the other, the object being to see how many times he can traverse the full length. Another stunt is to stop at each one and chin yourself or to hang long enough to count ten, then on to the next, and so on. Nearly all the feats that may be performed on a horizontal bar may be done on the ladder and a greater variety by far is possible.

The supports are made of 4 x 4" posts with a cross-piece resting on them, and are securely bolted together. If outside, they should be three feet in the ground and would be better to be packed with concrete. If inside, they must be bolted to a heavy lock or plate, which in turn is secured to the floor Figure 3 is an end view. "C" and "B" are blocks which support the long piece "A." "D" represents the bolts. In use the ends of the ladder fit between the bolts and the supporting blocks.

Figure 2 shows another simple arrangement for using a ladder for athletic work. The drawings make comment unnecessary. The low end of the ladder may be swung up and fastened like the high end. In Fig. 1, by resting the center of the ladder on one of the supports, a balancing ladder is obtained. If you utilize the



GYMNASIUM LADDER.

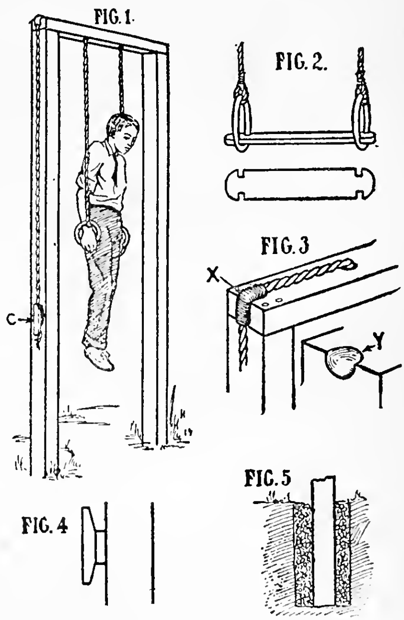
plan as shown in the sketches you will discover that an almost endless variety of stunts will suggest themselves to you.

A SWING TRAINER

As indicated by the picture, this simple device will serve for a swing, flying rings, and trapeze. In setting it up keep in mind the fact that the indispensable quality is strength. It must not wobble

very much, and the timbers used must be at least 4 x 6″ and of a strong, sound oak. For a fifteen-year-old boy of ordinary stature the height above the ground should be ten feet. The best way of setting the posts is to bed them in concrete. Dig your holes three feet deep and erect the timbers in a perfectly upright position. You will need a level to do this, and you must have light slats or props nailed to the uprights to keep them from moving while you are shoveling in the concrete. The concrete mixture is one sack of cement (100 pounds), costing forty cents, and eight cubic feet of broken stone and sand or river sand. Mix it thin and put in around the posts, a little at a time. Figure 5 makes the idea clear. It will take three weeks for the concrete to set firm and hard and during that time you must not touch the posts.

The top cross-piece has two holes bored for the rope, and a rounded notch Y for the rope to slide in. The cleat, Fig. 4, is used to shorten the rope by tying it around same. Figure 2 shows the shape of the swing seat and the method of setting it in place.

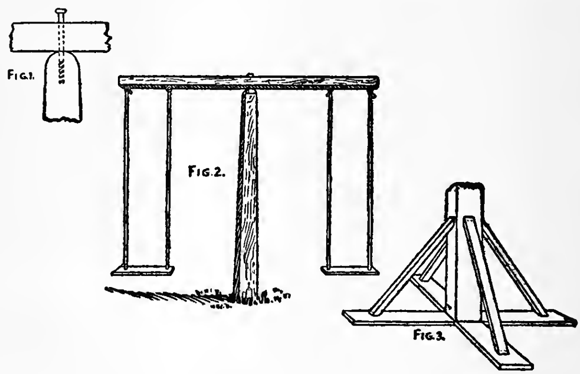


A SWING TRAINER.

A half hour's daily practice on this device will go a great way toward keeping a growing boy in good shape. A variety of stunts may be accomplished, such as chinning yourself, climbing the rope hand over hand, trapeze work, turning pole tricks, flying leaps, and arm exercises. Begin with ten minutes of light work and gradually increase it to a half hour, keeping it at this period for a year. Then with the fine development gained, you may attempt almost any reasonable athletic stunt.

A WHIRLING SWING

The device shown here is built for joy, but its use will give you muscle and a good appetite besides. It is a combination swing, merry-go-round, May-pole, and see-saw. Once set up, you will have a hard time getting your turn at it, for everyone will want to use it at the same time, and every day you will discover new uses to which it may be put. You and a friend can sit on it and teeter up and down, or you can swing back and forth or whirl around through the air. You can grasp the ropes with your hand and run around until it has a good motion, then leap upon the seat board and you will rock and swing and whirl at the same time. But enough said on that point—experience alone will teach you its



A WHIRLING SWING.

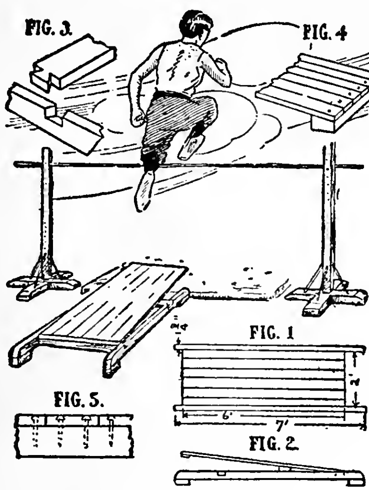
manifold uses. The center upright pole should be very strong and sound, ten feet long, 8 x 8″ at the base, and 4 x 4″ at the top. The legs or braces shown in Fig. 3 should be firmly spiked to the bottom, reaching a height of twenty-four inches from the lower end. Dig a large hole in the ground and sink it to a depth of three feet, so that about seven feet will extend over ground. Fill in the earth around the braces and pack it solidly. The cross-beam at the top is 4 x 4″ or even heavier, and about eight feet long. Figure 1 shows how it is secured with one large bolt, and also illustrates the proper shape of the top of the upright post. The swings are put in place by means of heavy eye screws and then you are ready for

some sport. If you have it in the back yard, which is perhaps the most likely place, paint it green.

SPRINGBOARD

A springboard is subject to so much hard usage that it must be made of the most durable material and very strongly put together. Hickory, ash, or maple would be my choice of material, in the order named. Toughness, springiness, and lightness, coupled with a straight grain, are the qualities we want.

For the base use two pieces of 2 x 4″ scantling seven feet long. Round off the top corners a little, and under each of the four ends



A SPRINGBOARD.

screw a piece of scantling four inches long and two inches thick. Next put in the front cross-piece, using the solid joint shown in Fig. 3. The rear brace, to which the springboard proper is fastened, is much larger and stronger. Use a piece of 4 x 4″ stuff for it and fasten with long screws. Underneath this, when in use, put blocks, so that it cannot spring down toward the floor. The top of this heavy cleat is beveled so that it will give the springboard an upward pitch, as shown in Fig. 4.

For durability it would be better to use two thicknesses of inch boards than one of two-inch stuff, for the springers. Screw them firmly together by means of a cross-cleat at each end, under same, and then attach to the heavy rear brace.

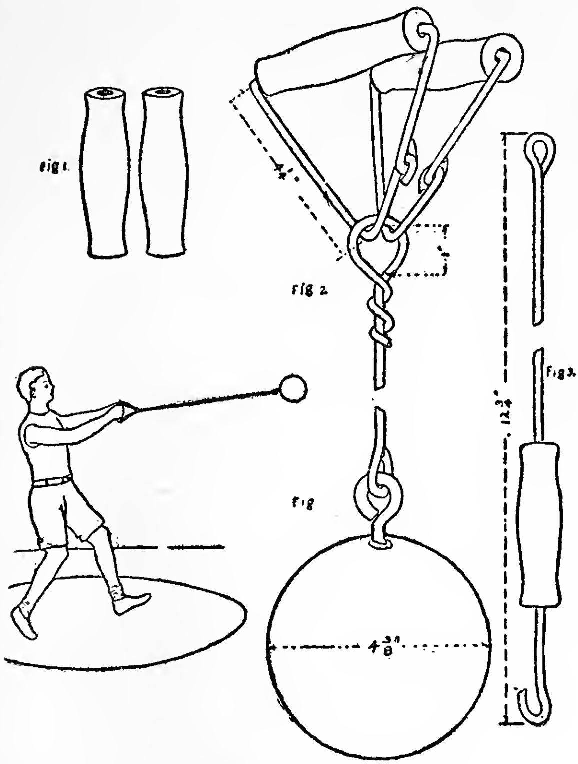
This board can be moved from place to place and is good for outdoor or indoor practice. It can be made to set firmly on the ground by driving stakes and spiking it to same. Indoors, blocks should be provided for it to slip under. Another simpler way is to have several boys stand on the rear end while one is taking his leap. The jumper must walk around and get on the rearmost part and so on. There is no livelier sport in the world than springboard leaping, and a surprising distance may be covered when you once get the knack.

A HAMMER-THROWING DEVICE

Hammer-throwing is a sport that the large, loosely built lad should go in for because it will make him solid and graceful, and his long arms and high stature are advantages of more value in propelling a ball to a great distance than superior strength. The strength he can gain by practice; the other requisites must be natural properties.

If you are going to buy a hammer, this plan will save you about three dollars. Just look in the sporting goods catalogue and you will see that the price of a twelve-pound shot with the usual long handle is $3.50 for the very cheapest kind. The one explained here is just as good as the store article and will cost you not more than fifty cents. The first thing to do is to get a large screw eye and place a nut on the end of it. The eye of the screw should be about three-quarters of an inch inside diameter and the length of the screw should be three inches. It is shown in Fig. 4. When you have procured this, take it to a machine shop or iron foundry and tell the proprietor you want an iron ball cast with the screw eye in the center so that the eye will extend up through the top as in Fig. 4. If you take this drawing with you he will understand instantly. The ball you want is to be exactly four and three-eighths inches in diameter and will weigh twelve pounds. If he has a pattern of that size he will make it for you for three cents a pound, or thirty-six cents all told, but if he has to make a pattern,

which can be done on a wood-turning machine in five minutes, he will charge you a little more. If he wants more than a half dollar, make the pattern yourself. When you receive the ball from the foundry, wire it up as shown, and vour hammer will be as ser-



HAMMER-THROWING DEVICES.

viceable as any you could buy for any price. For handholds or grips use old pail handles as shown in Fig. 1. The length used for each handle is twelve and three-quarters inches, each of the three sides of the triangle being four and one-quarter inches. It should not take you more than a half hour to complete the whole job.

CHAPTER VII

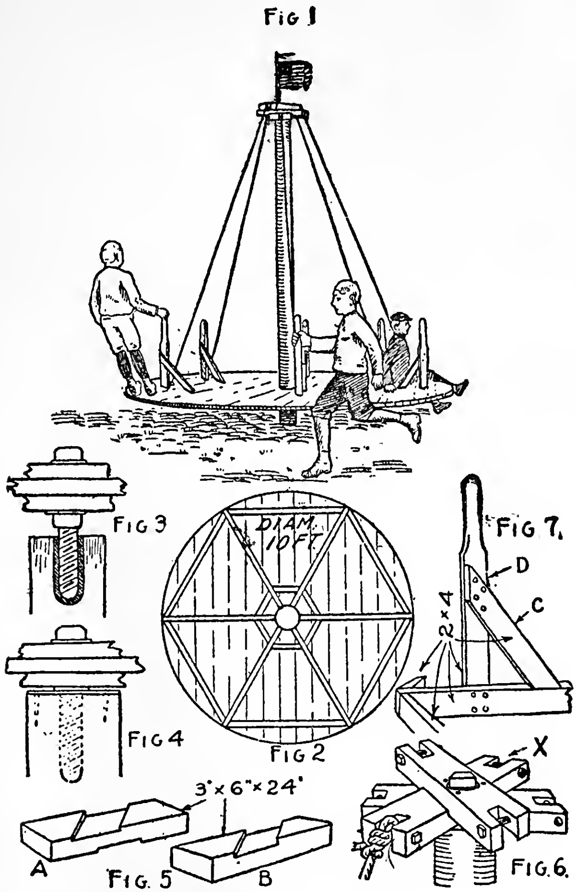
A Hanging Whirligig

THE device described here is built for joy alone, but incidentally will furnish good outdoor exercise.

To begin with, we must have a pole twelve or fourteen feet long and eight inches through at the base. This pole may be larger than this, for it is not possible to get it too stout and strong. It must set very firmly in the ground, for there will be a great strain on it. The height of the pole over the ground does not matter much. It may be from ten feet up or may be even seven or eight feet, but to make it firm at least four feet must be imbedded in the earth. A good plan to insure its being strong and remaining upright is to fill around with a 1-2-3 concrete mixture. This means that one part should be cement, two parts sand, and three parts stone. When the post is properly sunk the whirligig is sure to be a safe and enjoyable device. In the top of the post bore a hole about two inches in diameter to a depth of six inches. Then put one or more iron rings around so that it will not split. The rings may be omitted if the post is hard wood and pretty thick at the top, but you should at least wrap it with wire. On the top of the pole there is a three-spoke affair, made as in Fig. 6. Two of the pieces are shaped like "B" in Fig. 5, and one, the central one, like "A." Nail them securely together and bore a hole through the center. Through this hole pass a tightly fitting bolt and secure it with a nut underneath, as shown in Fig. 3. This turns around when the swing is in motion, and in order to reduce the friction you may nail a piece of sheet metal on top of the post. Pack the hole in the pole with grease and fit the bolt into it. Six ropes or cables hang from it, as shown in Fig. 6.

The skeleton work of the platform is shown in Fig. 3. Use sound 2 x 4″ pieces and fasten them with resined spikes or long screws. The upright handle used to push the machine around and to hold on to while it is in motion is shown in Fig. 7. The platform must be built around the base of the pole. When complete it is elevated about eight inches off the ground and the rope fastened

to it. Be sure to have it level, so it will turn evenly. If you wish to improve the appearance of the whirligig, paint it in bright colors, say, alternate strips of red and white, or make the whole thing



A HANGING WHIRLIGIG.

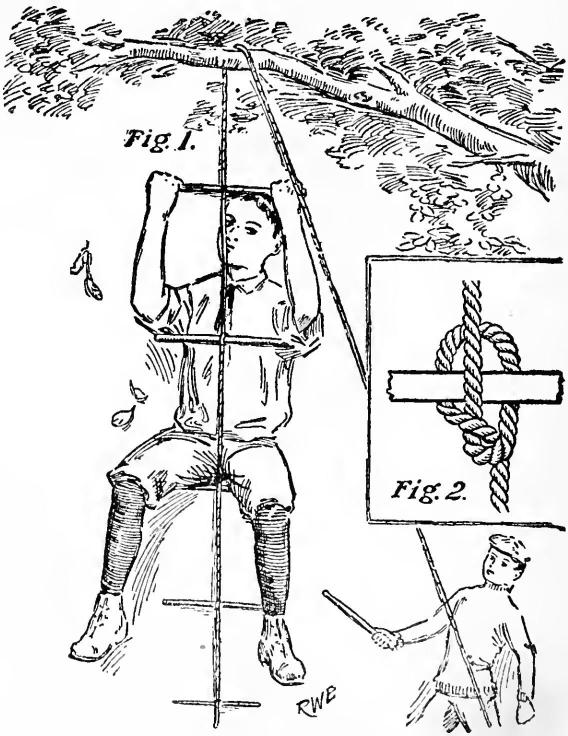
green. In using it you stand alongside, grasp the handle, and run. Six may do so at the same time, and when it has gained speed hop on and ride.

CHAPTER VIII

Two Tree-climbing Devices

FOR NUTTING SEASON

NUT trees grow tall and large and are quite difficult to climb. As a matter of fact, the nuts always seem to be high and out of



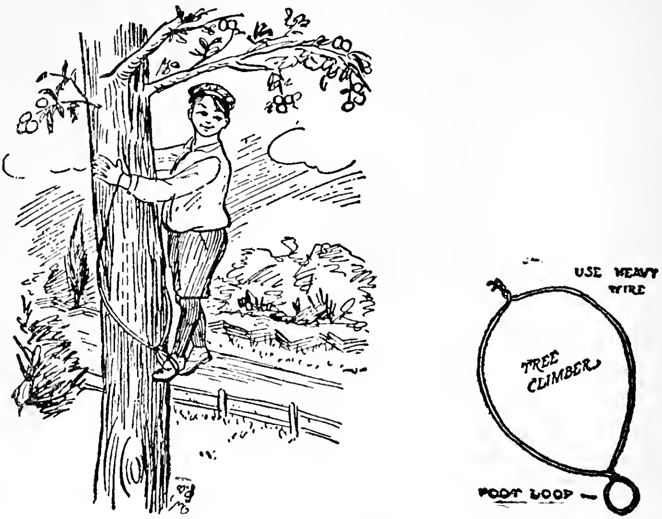
TREE-CLIMBING DEVICE, NO. I.

reach. This is because the lower limbs are stripped by wandering hordes of boys long before the nuts are ripe. After a few good frosts is the time to go nutting. In my younger days the big problem was to get the coveted shellbarks off the high limbs. Throwing at them with bricks and clubs was the usual method, but it could not effect thorough work, and the element of danger from falling and bounding rocks was no small thing. Another scheme was to nail cleats to the tree trunk like the steps of a ladder. This was quite successful, but the amount of lumber needed is surprisingly large and would bar it unless you are going nutting with a horse and rig. One of the most useful articles a nutting party can take along is a coil of half-inch rope about forty or fifty feet in length. By tying a weight on one end you can easily toss it over one of the lower limbs and the weighted end will drop to the ground. You can then grasp the double line and ascend hand over hand fashion, or simply hold fast to one line and let the gang pull you up. A better plan is to tie small cleats to your rope, as shown in the accompanying sketches. With the aid of this device a boy of ordinary strength can have as much fun as the usual wiry fellow, singled out to do the steeplejack work. One end should be tied securely to the tree trunk. The drawing shows how the climber is made and used.

A WIRE CLIMBER

By the use of the simple wire loop any lad can climb to the fork of his favorite tree, no matter how high it may be. The drawings show the shape and proportionate size of the device so clearly that further description is unnecessary. Make it out of wire that is about the thickness of a common clothesline, place it loosely around the tree about two feet off the ground, place your right foot in the small loop and grasp the tree as you would in ordinary climbing. Now draw the foot up as far as you can and the wire will catch, permitting you to again stand in an upright position. You may stand and rest any time you wish, and for this reason the highest tree need have no terrors for you. If you have never tried this device you have missed one of the grandest and most ingenious inventions of childhood. Make one, and practice on some smaller trees of your neighborhood before you tackle the large shellbarks. One very important detail is to make the loop

entirely from one piece of wire. If when in use it sticks and refuses to move either up or down, keep cool and touch it with the



TREE-CLIMBING DEVICE, NO. 2.

disengaged foot. There is absolutely no danger or chance of accident if you follow directions closely.

CHAPTER IX

The Bow and Arrow

Most boys who are fond of the woods and outdoor life have an instinctive desire to get back to primitive conditions, and scarcely a boy can be found who at some time or other has not "played Indian." While many of the Redman's traits and habits are scarcely to be recommended as an example, yet the self-reliance, healthy life, and knowledge of woodlore and nature brought about by imitating the savage are most beneficial.

Even if the outdoor boy does not act the part of the Indian, he will find added pleasure and interest in his woodland life if he learns to make his own weapons and implements, his own fishing tackle and camps, and can fashion his own moccasins and clothing from skins tanned by himself and obtained through his personal prowess as a hunter or trapper.

Almost any boy can become a good shot with rifle or shotgun, and with modern arms very little skill is required to hunt and kill ordinary game, and the habit of always carrying a gun or rifle in the woods and blazing away at every living creature cannot be too strongly condemned. Unnecessary slaughter is cruel, wasteful, and unsportsmanlike, and with modern weapons the advantage is all on the side of the hunter. Although a sort of savage instinct causes us to enjoy hunting, yet the real pleasure is in the chase itself and not in the actual killing. Hunting is the best of training for body, mind, and eye, but far more real pleasure may be obtained by using bow and arrows for weapons than by the use of your up-to-date gun. The boy who hunts with bow and arrows and depends upon matching his own skill and cunning against that of his quarry gets far more enjoyment and benefit from his hunt than his friend with the gun, and gives his prey a fair show besides. Moreover, wild creatures hunted with bow and arrows seldom become shy or wild, even if shot at repeatedly, whereas the report of a gun soon frightens all the game within hearing.

Even if you do not hunt, a good bow and arrows will lend added pleasure to your outdoor life, for target shooting at imitation animals can be made quite interesting and exciting.

Many of my readers may scoff at the idea of using a bow and arrows, for nowadays these implements have come to be regarded as mere toys or playthings by most people. You should not forget that the bow was the most important weapon of our ancestors for many centuries, and that the prowess of the English archers won many a hard-fought battlefield and laid the foundation for the great British Empire. Even our pioneer forefathers found the Indian bows and arrows dangerous weapons, while at the present time many tribes depend entirely upon the bow for hunting. Archery reached its highest development in the days of Robin Hood and the English bowmen, and while the stories of their deeds are doubtless greatly exaggerated, there is no question of the remarkable skill acquired by many of the British archers.

It is an easy matter to become proficient in the use of the bow, and within the last few years many lovers of outdoor life have adopted the bow and arrows as hunting weapons. It seems almost incredible that geese and ducks may be killed in flight by an archer, and yet such men as Maurice Thompson and his followers have repeatedly accomplished this feat.

Armed with a really good bow and properly made arrows any boy may easily become an expert archer, for practice is the only requirement, and you will be mightily surprised to find what a lot of fun you can derive from the use of these simple weapons. No one who has not experienced the sensation can possibly imagine the thrill felt by the archer at the twang of a taut bowstring and the soft whistle of a well-driven arrow, or the breathless interest with which he watches the flight of his feathered shaft as in a graceful curve it speeds straight and true to its mark.

The first and most important requirements for the archer are perfect bows and arrows, and of the two the arrows are far more difficult to make and are of greater importance. As there is little chance for outdoor life during the late winter and early spring, much of your time may be happily employed in preparing your equipment for the coming season, and no portion of your outfit is worthy of more care and trouble than your bow and arrows. It takes time and patience to make these weapons properly, and it

is an excellent plan to have several bows and a large number of arrows and strings on hand.

The first step in making a bow is to secure the proper wood. Yew, cedar, orangewood, lancewood, ash, elm, hornbeam, apple, and hickory all make good bows, but of all the native woods I prefer good, straight-grained white hickory. The wood should be thoroughly seasoned winter-cut sticks, and if there is a carriage or wagon shop in your town you will find that the best place to obtain the right material. Bows vary greatly in length, width, thickness, and shape with different tribes and people, but, as a rule, the long, slender bows are best adapted for target work and long range, while the shorter and broader forms are more suitable for hunting.

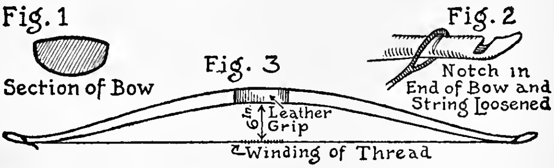
The North American Indians use short, broad bows, while the Central and South Americans use very long, slender bows, and both seem to succeed equally well. The arrows vary as much as the bows, and many of the South and Central American tribes use arrows four to six feet in length and entirely destitute of feathers. With such weapons I have seen them kill birds at the tops of tall forest trees and shoot fish several feet beneath the surface of rapid mountain streams. These peculiar arrows are, however, the exception, and you will do best to follow the more usual and conventional styles.

For ordinary hunting use, your stick of wood should be about five feet long and two inches square, and should be cut so that the line between heart and sap wood runs exactly through the center. However, you should not be discouraged if you cannot obtain a piece with both heart and sap wood, for excellent bows may be fashioned from clear hickory or other wood, provided the grain is straight, fine, and free from knots or curls.

The stave should then be worked down with draw shave and plane until about an inch thick and an inch and a half wide for fifteen to eighteen inches in the center, and from this should taper off to about three-fourths of an inch wide and half an inch thick at the ends. Great care should be used in scraping and working down the bow in order that the heart and sap wood may remain of equal thickness the entire length. As you work you should test the bow frequently to see that both ends bend evenly, and all the surface should be scraped with glass, rubbed smooth with fine

sandpaper, and kept as smooth and even as possible. The bow should be flat on one side and slightly convex or rounded on the other, and the flat side should be the outward side when bow is bent (Fig. 1). The exact size of the bow depends upon your own strength and judgment, but, as a rule, a bow drawing at from fifteen to thirty pounds is about right for boys' use. A short distance from each end you should file or cut a smooth diagonal notch on each side and connect these by another groove across the flat side (Fig. 2). The bow should now be rubbed with linseed oil (being very careful not to put on too much or the spring will be lost), and then rubbed until polished with paraffine, bayberry wax, or similar polish.

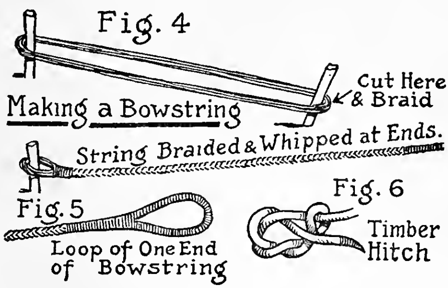
At the center of the bow a space about six inches long should be covered with soft leather or cloth glued in place and with the edges neatly sewed together on the back side of bow. This serves



as a grip for your hand and prevents slipping of the arrow (Fig. 3). An excellent grip may be made by winding the bow with fine and strong waxed linen thread or by winding with adhesive bicycle tape. The string is now the next thing to make, and as bowstrings are often broken or frayed, the boy archer should provide himself with a number of extra strings. Catgut, sinew, and rawhide are all used as bowstrings, but I have found clear, unbleached flax or hemp the best material. To make a hemp or flax bowstring secure the best shoemakers' flax and some shoemakers' wax. Wax the thread thoroughly and wind it around two nails or pegs seven feet apart until you have fifteen or twenty strands (Fig. 4). Wax these and cut through the bunch of strands where they cross one of the pegs. Divide the strands into three equal parts and braid them loosely together. Now wind one end of the braided string with fine silk or linen thread thoroughly waxed. At the opposite end make a neat, smooth loop by winding the string

where it goes around the peg, and then, removing it from the latter, wind the loop formed by the unbraided threads (Fig. 5). Now slip this loop over one end of your bow, draw the other end of string around notch in opposite end, and bend the bow carefully until the string stands out about six inches from the bow at its center (Fig. 3). Secure the string by a timber hitch (Fig. 6) around the other notch and wind a space of six or eight inches in the middle of the string with fine silk thread (Fig. 3). Loosen the string by slipping off the loop (so it slides down on the bow) (Fig. 2) and give all the windings a coat of quick-drying varnish or shellac.

For arrows you may use either white pine, Oregon spruce, Norway pine, ash or hickory. For target use, pine arrows will do, but for hard use and hunting ash is the best material. Indians

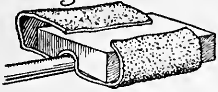


often use straight shoots of arrow wood (Viburnum) and similar shrubs, but it is very difficult to obtain these perfectly straight. If you wish to try this sort of material you can make the shoots much straighter and better by hanging them up while green by one end with a heavy weight attached to the other and allowing them to dry thoroughly in this position.

In making arrows from wood secure a block of perfectly straight-grained, well-seasoned pine or ash about twenty-four to twenty-eight inches long and split this in half; split each of these pieces in half again, and continue halving the pieces until the pieces are all split into straight sticks about half an inch to three-quarters of an inch square. Place these sticks on a smooth level board or bench and plane them straight, working around and around until the sticks are smooth, fairly round, and *absolutely straight and true.*

When all your sticks are in this state, go over them with coarse and then fine sandpaper, and work at them until they are as round and smooth as possible. If you work the sandpaper with your hand or fingers your arrows will be very likely to have hollows in them, and to avoid this cut a half-round groove lengthwise of a block of soft wood and place your strip of sandpaper in this and use it like a plane (Fig. 7).

Fig. 7



Block for Sandpapering the Arrows.

The next step is to cut notches in the arrows. Examine each stick and determine which way the grain runs, and in the end *toward which the grain runs* cut a smooth notch one-quarter of an inch deep and wide enough to readily admit the wound, central part of the bow-string. A fine saw-notch, smoothed and widened with a fine file, is the best and easiest to make, but very good notches may be made with a small-bladed penknife (Fig. 8).

To feather your arrows, secure a number of stiff wing feathers of some large bird, such as turkey, eagle, swan, goose, blue heron, gull, cormorant, pelican, or crane. Keep the feathers from each side of the bird by themselves, for if feathers from opposite sides are placed on one arrow you will obtain very poor results, owing to the different curves of the feathers. Strip the feathers or plumes, with a thin piece of the midrib attached, from the quill and cut these into pieces of even length and trim so that a short piece of the midrib projects at either end (Fig. 9). Now mark three lines on your arrows, spaced equal distances apart and so arranged that one comes opposite and at right angles to the notch, while the others are nearly parallel with it (Fig. 10). These lines should be drawn on with a ruler or straight edge, and if they all turn slightly at an angle or "twist" they will result in better feathering, for these marks are to guide you in fastening on the feathers, and the feathers act like the grooves in a rifle barrel, causing the arrow to revolve in flight and thus travel straighter and more evenly,

Fig. 8 Notch in Arrow

Fig. 9 Strip of Feather Ready for use

Fig. 10 End of Arrow Showing Position of Feathers

as well as to prevent its tendency to turn end over end or "key-hole." Your arrows being marked, glue the strips of feathers along the lines, keeping them straight and true, and finish by winding or lashing the projecting ends of midrib with fine waxed silk or linen thread (Fig. 11). Indians use sinew to wind on the feathers, and there is no reason why you should not use similar material if you wish. Remember, however, that the materials used by savages are due to necessity and not choice, and that the uncivilized man is only too anxious to adopt civilized materials whenever he can obtain them. Place your arrows in a cool, dry spot, and while the glue is thoroughly hardening you may prepare the tips, or heads, of your arrows. These may be made of hardened wood, brass, horn, stone, bone, or iron. For hunting purposes wooden heads, hardened by fire, will answer, but these soon become dull and their light weight has a tendency to cause erratic flight. Brass or steel ferrule heads may be purchased of sporting goods dealers at nominal cost, or may be made by any blacksmith or machine shop by drilling a hole in pieces of rod (Fig. 12, 1). Bone makes very good heads, but is too brittle for everyday use. Horn makes good hunting points and is excellent for birds and small animals, although for birds blunt wooden or bone heads answer very well (Fig. 12, 2-3-4). In certain districts—such as Ohio and Indiana—where stone arrow heads are found in large numbers, the boy archer may readily obtain excellent stone arrow heads for hunting use (Fig. 12, 6). The best heads of all for hunting and general utility are made from thick hoop iron, or thin steel, and these can be cut up into any shape desired (Fig. 12, 5). Steel wire nails may also be used as arrow heads with good results (Fig. 12, 7). Use your own taste and judgment as to material and shape of heads, and when you obtain good results, stick to your own style. The heads—if of ferrule pattern—are merely glued in place, but if made of horn, bone, stone, or sheet metal, should be inserted in a notch, glued in place, and the shaft wound tightly with very fine copper wire or strong thread. This lashing holds the head in place and prevents the arrow from splitting, and should be wound as evenly and tightly as possible and thoroughly waxed and var-

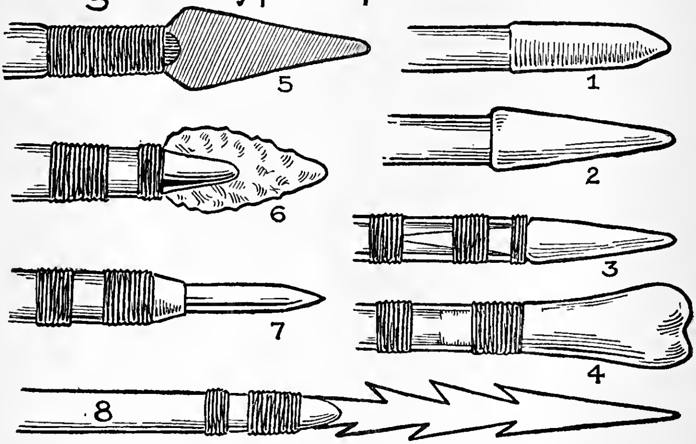
Fig. 11

Feathers Glued & Lashed.

nished. The last step in finishing your arrows is to varnish or paint them, and as bright colors render arrows more readily seen among brush or grass and serve to distinguish one boy's arrows from those of another, there is nothing better to use than quick-drying enamel paint.

When the arrows are thoroughly dry you may go forth and try your new weapons, although before doing so I advise you to prepare a quiver and an arm guard.

Fig. 12 Types of Arrow Heads



1 Ferrule Head
2 & 3 Horn Heads
4 Blunt Bone Head
5 Sheet Iron Head
6 Stone Head
7 Nail Head
8 Iron Fish Head

These may well be made while your arrows are drying, and, while not absolutely necessary, they are very useful. A bow case and quiver combined is easily made from leather or canvas and may be ornamented and fringed to suit your own fancy (Fig. 13). The bow case should be long enough to completely cover the bow and loose enough so that the bow may be readily and quickly drawn when needed. The quiver should be a little shorter than

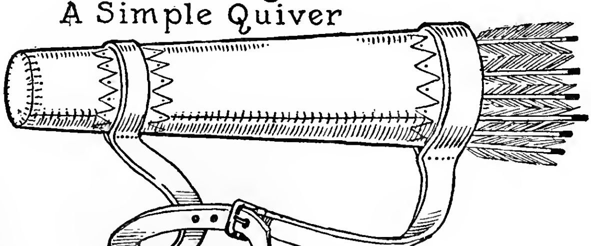
the arrows and fairly stiff, and a study of the illustration will show you how to make it without any description (Fig. 14). The arm guard consists of a piece of flexible leather —an old boot leg does very well—laced or buckled on the arm which holds the bow, to protect the wrist from the bowstring (Fig. 15). You will also find gloves, with tips of fingers cut off, a great help, for the feathers of the arrow and the snap of the bowstring will soon chafe and cut your hand and fingers if you shoot very much.

Fig. 13

Indian Bow Case & Quiver Combined

To use the bow with success you should stand with your heels in line with the target, your left hand with bow extended toward the target, and at almost right angles to your feet. Place the arrow on the string and rest it across the bow and on and across your thumb and finger of the bow hand. Now hook your first three fingers of the right hand over the string with the notched end of arrow between the first and second fingers (Fig. 16). Raise your bow hand to the level of your chin and draw back on the string and arrow with your right elbow raised almost to your shoulder line and in *line with the arrow* (Fig. 17). Draw until the head of the arrow is almost to the bow and, glancing along the arrow until in line with the

Fig. 14
A Simple Quiver



target, release the string by opening the crook of right fingers. Keep your left hand and bow fixed till the arrow strikes and watch the result. Doubtless your first few arrows will fly wide of the mark, but note whether they travel to right or left, above or below, and you will rapidly improve. Learn to draw your bow in exactly the same manner every time, and re-

Fig. 15

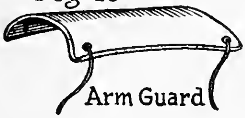
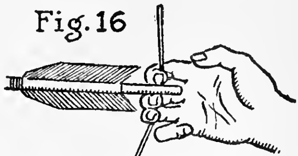


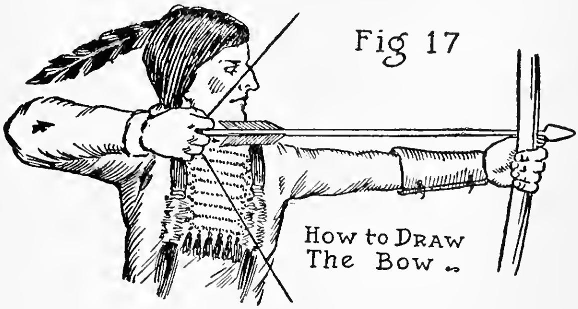
Fig. 16



How to grip the Bowstring.

member to draw your right thumb to the same spot on your cheek at each shot. This will result in uniform shooting and failures may be more readily corrected. You will find that there is a most remarkable variation in the way your arrows act. Some will fly almost straight, others will swing and wabble, others will travel

Fig 17



How to Draw The Bow

through a wide arc or curve, and still others will prove so erratic that they cannot be depended upon to shoot true. Discard the latter, if after trying trimming the feathers or fitting new heads they are still unsatisfactory. Every arrow (even though made exactly alike) has distinct individuality, and the successful bowman studies the peculiarities of each shaft until he knows instinctively

just which arrow to select from his quiver for each and every purpose and condition.

Some arrows travel best on windy days, others on calm days; some will shoot straightest against and others with the wind, and some are better for long than short shots, and vice versa. An expert arrow maker can fashion an arrow for a certain purpose and knows just how to trim and set the feathers and balance the head to develop the best possible results; but this knack can only be acquired by long and constant practice and experiment and cannot be described or taught. As a rule, the long, small-feathered arrow is best in the wind, while a large-feathered shaft is superior in calm weather, but much depends upon the size and weight of the head and the general balance of the arrow.

In shooting at a mark use an old sack or similar object stuffed with hay, leaves, or straw; or place your mark on a hay stack. Unless you *have arrows to waste, never shoot at a hard object,* such as a tree, fence, barn, or post, for the impact will be almost sure to spring or split your arrows.

Excellent practice may be obtained by setting up cardboard or cloth birds or animals backed with a sack of straw, for in this way you learn far more than by shooting at a conventional target of rings and bull's eye. You should commence shooting at a mark not over twenty or thirty yards distant and gradually increase the range as you become more skillful. When you can drive three out of five arrows into a paper deer at sixty yards you may consider yourself quite proficient and need not fear to try your hand at real game. You will find, however, that shooting among trees or brush is far harder than in the open, and for that reason I strongly advise you to practice in the woods a great deal, setting up your imitation game at various distances and under various conditions of light and shade.

A very interesting and instructive game may be played by a number of boys traveling through the woods and dropping bits of paper or beans for a "trail," and setting up cardboard or cloth targets representing game in spots that the real game might select as resting places. The archers are to follow the "trail" exactly as if they were stalking real game, and as soon as they see the quarry are to shoot. This method may be varied by having the trail makers attach a string or rope to their targets, and as the

archer draws to shoot they should endeavor to jerk the target out of sight before the arrow reaches it, thus more closely imitating the action of a wild animal. This will teach the bowmen to act more rapidly and surely and will develop far more skill in stalking and shooting than a fixed target.

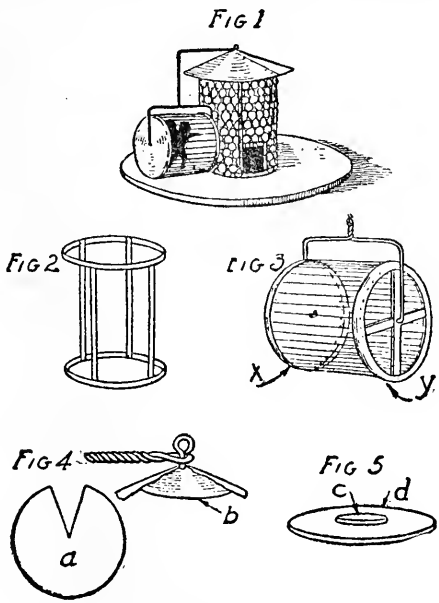
Running or jumping targets are easily designed and will prove most useful in perfecting your marksmanship, while the ambitious bowman will not be content until he has become an expert wing shot and can pierce a cloth ball or pasteboard box when thrown into the air at ten or a dozen yards.

CHAPTER X

Miscellaneous Things Handy for the Boy to Know

ANIMAL CAGE

EVERY boy has use for a small, secure cage in which to keep squirrel, rabbit, woodchuck, or other small creatures it has been his good fortune to capture. The one described below is easy to



ANIMAL CAGE.

make and will not let your captive escape. If you read the directions slowly and picture each part in your mind as you go along you will find it easy to understand, for any minor point that might escape you will be made clear by a glance at the pictures.

Let us begin at the foundation. It is a large, circular piece of wood, one inch thick and about three feet in diameter. The disk in the center should be about eighteen inches in diameter. The way to lay it out is to tack your flat boards to the barn floor, then with the aid of a pencil and piece of string draw both circles. It is then easy to saw on the marks and cleat the short pieces that go to form the disk together. Cut the smaller disk the same way and nail it in the circle you have marked out.

Now for the upright cage in the center of this base. It is cylindrical in shape. For a frame use two or more barrel hoops and four upright pieces as in Fig. 2. When you have made this frame, cover it with poultry netting of fine mesh, leaving an open space at the bottom for a door. The roof is made by bending a piece of tin into the shape of a shallow funnel. In Fig. 4 "*a*" shows how to draft it out.

Now for the cylindrical cage that lays on its side. One end is a solid wooden circle, the other end is open. The cage is made by running stiff lateral wires from one end to the other. The space between the wires should be about three-quarters of an inch. When you have it completed, lay the open end flush against the open space or door in the upright cage and get your measure for the wire by which it hangs in that position. The arrangement of this wire hanger is very clearly shown by the cuts.

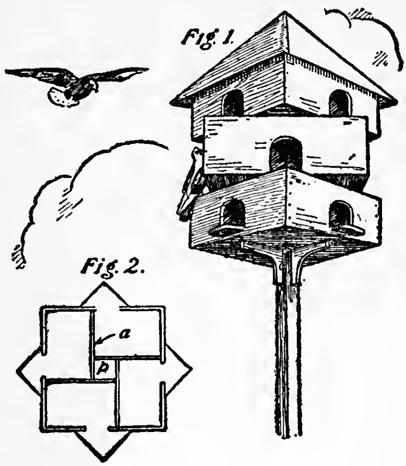
The theory of the cage is this: The animal in climbing up the wires of the flat cylinder will cause it to rotate and go forward, just like rolling a hoop. When the inside open end and the door are opposite each other he may pass into the central cage. It is great fun to watch the gyrations of the cage, and the animal will enjoy the exercise more than a little.

A BIRD HOUSE

The picture illustrates a neat and serviceable bird house. It is made of three shallow boxes set at angles upon each other. The size of the boxes depends upon your own taste. For ordinary purposes eighteen inches square and six inches deep is about right for each. In designing the house it was intended as a refuge for untamed birds and so as many compartments as possible were made. Each of the shallow boxes is divided into four spaces as

shown in Fig. 2. The space "*p*" is where the post comes up through the center. The perches and openings are cut out with a small circle saw. The roof is of tin or galvanized iron. It is made of four triangles lapped over each other and riveted. Two coats of steel gray paint on the outside will add to the appearance of the house and make it weather resisting.

It should be set upon a high post and made as inviting as possible for the feathered visitors. Remember that as man has encroached upon the domain of the wild creatures only three courses were

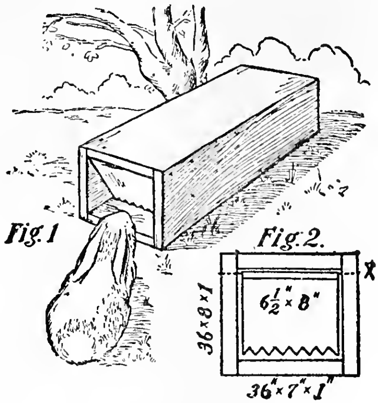


A BIRD HOUSE.

open to them: either to move to remoter regions, to adapt themselves to modern conditions, or to die out altogether. The robin is one of the species that has made the best of things and tried to stay with us. It is interesting to study its habits, and this shelter will aid you in doing so. Here are some things to discover for yourself. Do the robins arrive from the South singly or in flocks? Do the sexes migrate together? How long after the arrival does nest building begin? What is their food? Is it the same in various months? All these and a dozen more lines of inquiry will make the shelter interesting.

RABBIT TRAP

This rabbit trap is about as simple as anything could be, and is highly praised by those who have tried it. It is a long box with one closed end. The other end is fitted with a door, which hangs like a curtain. It swings inward easily, and it is presumed that the animal to be trapped will push its way in, but it cannot swing outward, as the bottom strikes a cleat which prevents this. The scallops on the bottom of the door provide a means for the entrance



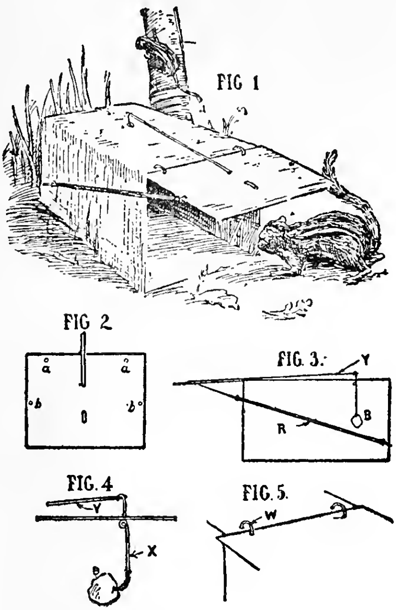
A RABBIT TRAP.

of air to the prisoner. The swinging door may be made of tin or wood. "X" is a piece of wire which runs through it and into the sides of the box.

A CLEVER TRAP

A simple and very effective trap for trapping squirrels and rats may be made as follows: Procure a square tin can, either a varnish can or one used to contain cocoa will do. Get a rectangular piece of tin to fit over the opening in the can and make six holes in it, as shown in Fig. 2. The two marked "*a*" are for the wire used to hinge it on to the can, the pair marked "*b*" are for rubber bands which will keep tension enough to slam the door shut when the bait is tampered with. Now you want a piece of stiff wire six

inches long, and another bent into the shape of Fig. 4. This is the trigger, the lower end of which, "x," contains the bait, "b." You can now use the wire as shown in the completed sketch to hold the cover up, over the rear end of which is hooked the trigger wire. Rubber bands, stretched quite tight, run from the middle of the cover to the back end of the can. Figure 4 shows clearly how the



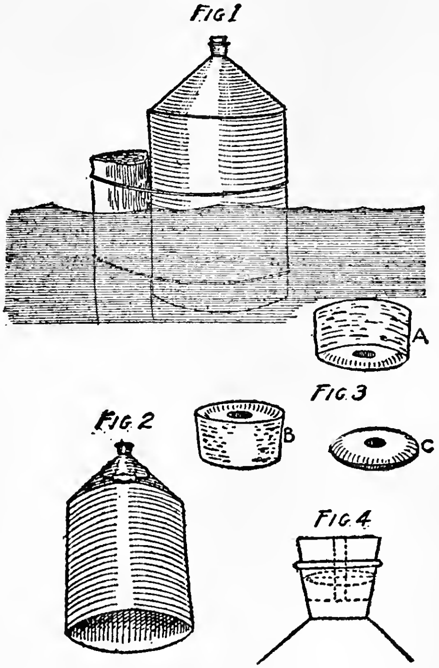
ANIMAL TRAP.

trap is set. When the bait is touched the wire "x" is thrown off its slight hold on the cross-wire that runs through the rear, and the spring of the rubber bands snaps the door shut.

WATER WHISTLE

If you have a summer cottage or live permanently near the water you will want this water whistle. It is simple and easy to make and demonstrates a scientific principle. Procure a large can with a conical top and cut off the bottom. In the open-

ing at the top of the can fit a cork or a wooden plug. A cork is the better because the plan requires an air-tight fit. When you have accomplished this, remove the plug and bore a hole through its center. This can be done with the small blade of your pocketknife. When the hole is bored the cork is cut in two horizontally. The cut ends are scooped out in concave form



A WATER WHISTLE.

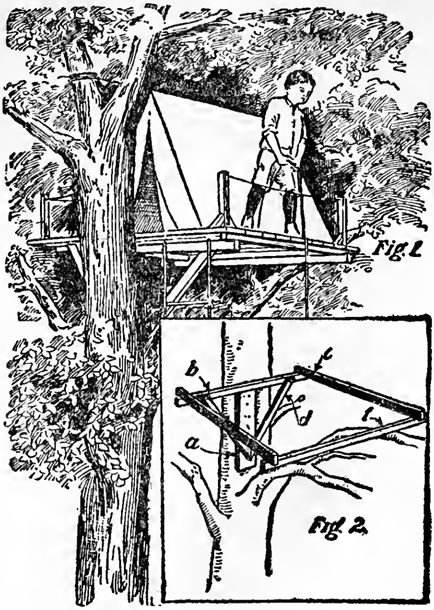
so as to snugly contain a small tin whistle of the type shown by "*c*." Place this whistle on top of the lower half of the cork and place the latter in the neck of the can. Wedge it down air-tight and then place "*a*," the top part of the cork, on it, also making it fit snugly. We now fasten the can to a post near the edge of the water by wiring it on in the manner shown. I might add that it is not necessary to place the post near the edge of the

water, the only requirement is that the can be about half submerged in normal weather. When the tide rises or when the water is rough and the waves wash about, the whistle will emit regular blasts. It works on this principle: You know that it takes a blast of air to make a whistle sound. It is the action of the air passing through the hole that causes the vibration which results in the shrill noise. Now if the whistle was in your mouth it would be easy enough to blow or suck in as you chose. In this case the top half of the can is filled with air, and when the waves wash in the bottom of the can this air is suddenly compressed to about half its former size. The only escape is through the whistle in the cork, and, of course, the sound results. It will be good fun to rig it up near the cottage, and when the day is stormy you will be warned and will also be able to note the quieting of the waves without going out to see.

A TREE TENT

You have heard of tree houses and you have heard of tents, but it is doubtful if you ever saw the two ideas combined as in this sketch. In building the platform upon which the tent is to be erected too many braces cannot be used. If you intend it to support the weight of two or three boys, build it strong enough to bear up a dozen. In beginning the framework follow Fig. 2 as closely as possible, and add long and short braces wherever they will fit. The piece that is nailed to the tree is a short length of two-inch plank; all the others are 2 x 4″ scantling. For the floor of the platform one-inch pine should be used. The tent is put up by passing a line under the highest point and tying it to the tree at each end. In other words, it is hung like a sheet on a clothesline. Then the bottom is stretched out and secured to the wooden base with spikes and short lines. This plan eliminates supporting poles and guy ropes, and affords just as much shelter as it is possible to get from a tent of this size. It is great sport to camp out in this tree house during the hot weather, and, according to the fresh air agitation, it wouldn't be a bad place to bunk all the year round. If you are interested in bird study you will no doubt find it an advantageous place from which to observe the feathered creatures and to get short-range snap shots of them. The tent is reached by

means of a rope ladder which is drawn up after you ascend. It is said that all mankind dwelt in trees at one time. Let us go back



A TREE TENT.

to nature for a short visit, but use caution and common sense, for we may not be able to stand a fall like some of our Darwinian ancestors.

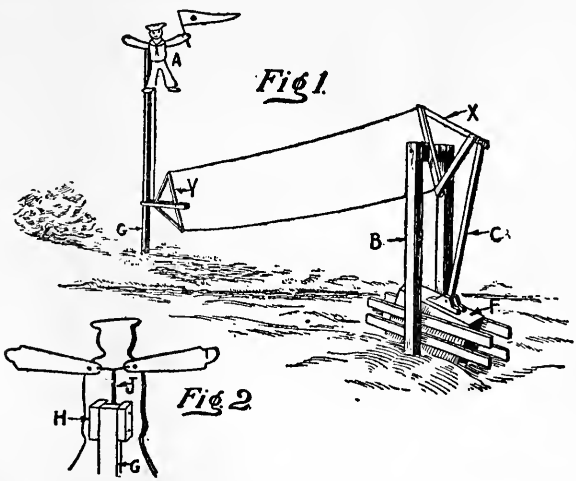
A WAVE MOTOR SIGNAL

There are many uses a wave motor signal can be put to by boys who live near the water. It will be fun to construct one, and you will find all sorts of uses for it after it is done.

First drive the two posts into the bottom or weight them sufficiently to make them maintain an upright position. At the top of the posts bore a hole right through both and insert a long bolt through them and through the arm (3 x 1 x 18″) that is to be between them. You will also have to use a block on each side of

this arm, as the picture shows. Now nail on the piece "X" and another one like it, only not so long, underneath.

The buoy or float is a hollow box or cask, suspended by the piece "C" from "X." Strips nailed to the heavy posts, near the water's surface, will keep the float from straying. Now on the land you sink another post, "G," and fit to it the rocking arrangement, "Y," which is in every respect like the one we have just explained. From the point or extreme left end of this rocker a line leads to the back of the sailorman, "A."



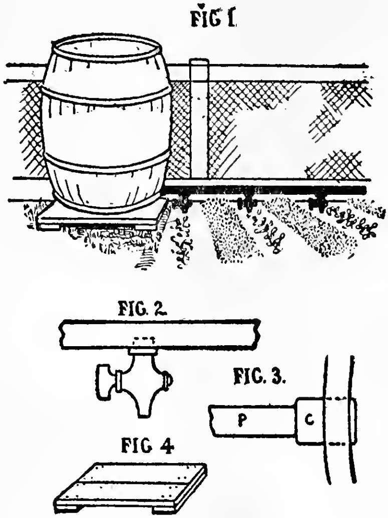
WAVE MOTOR SIGNAL.

The sailor is cut out of thin wood. The only parts that move are the arms, which rise and fall as they are actuated by the line. In Fig. 2 you see the back of the sailor. "J" is the line which is attached to the arms. The other parts are simply to keep the line in place.

It is great fun to build this signal device and watch it work. At night you can put a light in the sailor's hand instead of the flag, and if you live near a foggy or treacherous coast it may be of some real service to some one in distress.

AUTOMATIC WATERER

Everyone knows that the worst thing about gardening is the fact that you have to sprinkle each evening. Now, a certain boy had a bed of celery plants in the customary trenches and he decided to do away with some of the labor of tending them. He set a large water-tight barrel on a platform beside the last trench and bored a hole near the base. In this hole he screwed a gas-pipe and made the joint tight by means of lock-nuts. The long pipe had been



AUTOMATIC WATERER.

bored at the blacksmith shop to receive valves as in Fig. 2. Instead of boring in this manner he could have used tees, and in that case he would have been able to do the work himself. The end of the pipe is closed.

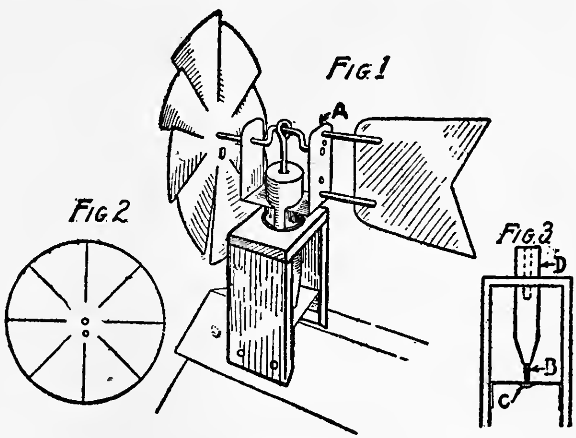
To water one row of plants all you have to do is to open the valve, but the bed must have slope enough to conduct the water to the far end. One or more trenches can be flooded without interfering with the others. If convenient you could place your barrel where the rain from the shed roof could be conducted

into it, otherwise you will have to keep it full by hauling water.

The waterer works well and will prove a convenience to the young gardener.

A WINDMILL

The picture herewith shows a neat and practical windmill made altogether of tin. You can get ample material for it from grocery cans. To begin with, make a wooden frame of three pieces of one-inch pine, the top part having a hole bored through the center. Between the side pieces, near the base of the frame, a piece of sheet



A WINDMILL.

metal is stretched across and fastened permanently with nails. Note "C" in Fig. 3. The next part is the upright post "D," which has a nail "B" driven in the point. The purpose of the nail resting on the tin is to reduce friction and permit the post to turn easily. If you understand that thoroughly the remainder of the plan will come easy. Observe also the hole in the center of the post.

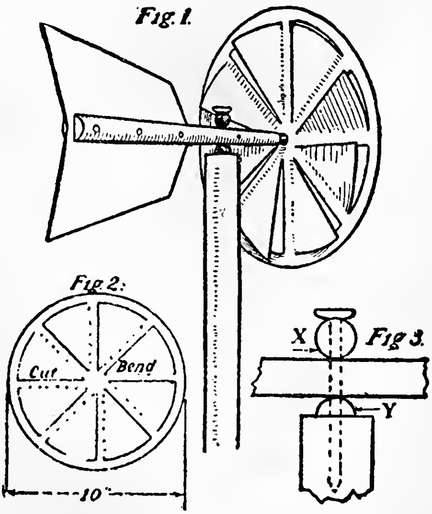
Our next step is to tack the two tin strips "A" to the center post. They are used to form a support for the rest of the windmill. We will now drop into the hole in the post a short wire with a loop or eye at the top. It should be one inch shorter than the hole. You notice that the crank shaft is bent like a crank in the middle,

and that the bent part passes through the eye in the wire we have dropped into the hole in the post. When the mill turns the straight wire will move up and down. This is to illustrate to you how wind power may be used to operate a pump.

Now on the right side we have the tail piece which keeps the fans properly in the wind. It is fastened with wire. On the left side we have the wheel itself. On a flat piece of tin draw the diagram marked Fig. 2. Cut the radial line with a shears to within one inch of the center, then bend the blades to an angle of 45 degrees. The two holes in the center of the tin disk are to permit the wire to be bent back and fastened. You will have to exercise patience in order to get a neat job.

A TIN WINDMILL

The windmill is the first attempt of man to harness the forces of nature. Perhaps that is why interest in the subject never flags.



A TIN WINDMILL.

Every man and boy has at some time or other made a windmill. In fact, from my own immediate neighborhood to the farthest

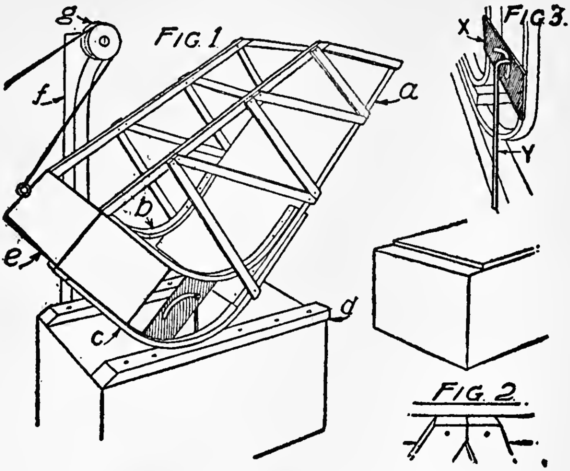
point I have ever been, evidence of boyish attempts to set a wheel spinning by the force of air currents is visible. The trouble is, they all follow in the same old rut. Here is a neat, speedy model, old in principle, but new in treatment. First comes the upright post. A good sound broom handle is just the thing. The wheel is made of one piece of tin. We show it here ten inches in diameter, but you can make it as much larger as you wish. Mark it carefully as shown in Fig. 2. Cut on the heavy lines and bend back on the dotted lines. A light stick runs across the top. Punch a hole in the center of the tin disk and through it nail the same to the cross stick. Touching the tin at each side is a bead used for a bearing. The nail must, of course, pass through the beads. The nail which is the shaft by means of which the horizontal shaft turns upon the upright post is also arranged in the same manner. This most important point is made very clear by the detail sketch Fig. 3. "X" and "Y" are the beads; the dotted line is the nail. The tail piece is fitted in by first making a saw cut in the cross stick. It is then tacked in place. If carefully made the model is very light and neat.

A MODEL LIFT BRIDGE

Boys of a mechanical turn of mind are always constructing models of one kind or another, and it is to such apparently foolish play that we are indebted for all our modern marvels of machinery. The lift bridge shown here is quite a modern idea and has proved very efficient for small streams.

And now for our bridge. The floor and trestle may be made from cigar box wood except the heavy block which is at the left end. In order to curve the pieces used as rockers soak them in boiling water for a while. Figure 3 shows the device used for keeping the span from sliding back. It is simply a piece of tin with a hole in it shaped like the arc of a circle. A wire post bent over at the top fits into this arc and keeps the bridge firm. You can raise the bridge with your hand or use the line and pulley shown in our cut. On the block which supports the heavy end of the bridge erect a small post and fix to it a pulley made of a silk spool with a wire axle. The cord passes over the spool pulley and is tied to a hook at the top of the bridge. The trick is to balance the span so nicely that only a slight impulse is necessary to move it. After the model

is in working order the block at the left may be made lighter by boring holes in it, and heavier by filling them with lead. Remember the line is only used to bring the bridge back to its natural



A MODEL LIFT BRIDGE.

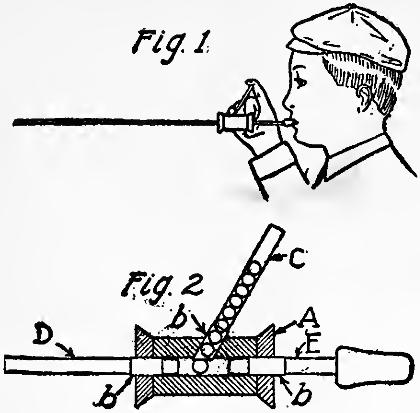
position, and when the tension is removed it will tilt up of its own accord. For this reason it is probable that you will have to weight the block as suggested.

A BEAN BLOWER

Here is a toy weapon with which boys are well acquainted. It is an improvement on the old-fashioned bean shooter, having a magazine section which holds ammunition in reserve. It is probable that the majority of readers will readily understand the plan at a glance.

In the first place you get a common spool, "A," and drill a slant hole from the outside to the center bore. Into this you insert the magazine tube, "C," it being simply a three inch length of the ordinary bean shooter. In order to make an air-tight fit cover the end that enters the spool with a tissue-paper collar or a wrapping

thread, "*b*." The other parts of the tube, "D" and "E," must also have this wrapping. The section shows how the magazine



A BEAN BLOWER.

works. The peas it contains will drop into the horizontal tube as rapidly as the ones before them are expelled from it.

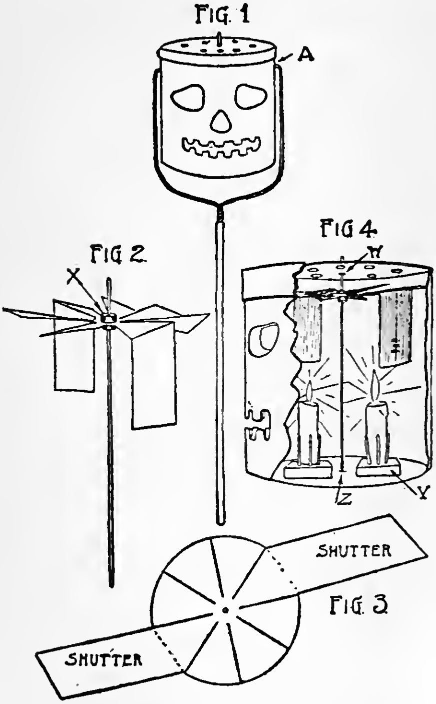
A HALLOWE'EN GHOST

Here is a Hallowe'en toy that will provide plenty of amusement for yourself and friends. It is intended for big and little boys and, in fact, the older members of the family too, for they will enjoy its queer gyrations quite as much as the youngsters.

It is a moving toy, that is, the wheel inside turns and alternately blots out one eye and then the other. This gives the face a ghostly winking appearance that will scare the natives up your way or at least set them trying to figure out how the thing works.

The material needed—a tin can, piece of cardboard, a cork, and some wire—may be found almost anywhere. First mark the face with lead pencil on the can or pail, and cut it out by punching holes with nails and trimming with old scissors. In the cover or lid punch eight or ten holes to permit the escape of smoke and heat from the candles. Next get the large piece of cardboard and lay it flat on the table. Place the can upon it and mark a circle around its lower rim. With a ruler then divide the circle into

eight sections, as shown in Fig. 3. Now cut it out with scissors, being careful to make it small enough to fit inside the can and also to leave on each side an overhanging strip marked *shutter*, in Fig. 3. The heavy black lines that divide it into sections are cut from the outside edge to within one inch from the center. The shutters are then bent down and the blades are bent to an angle of 45 degrees, which means halfway between being flat and upright.



A HALLOWE'EN GHOST.

Glue a flat piece of cork about the size of three nickels laid on top of each other to the center of the paper disk on top and a similar one directly under it. Now plunge a straight, stiff piece of wire through the center of cork and paper as shown in Fig. 2. You can now place the candles in the pail and then the wheel and wire. At the point "Z" in Fig. 4, where the lower end of the wire rests, you may make a small dent with a nail so that the end of the wire will not slip out of place. At the point "W" the top end of the wire passes up through the cover of the pail. The candles may be lighted by inserting the match through the mouth part. The hot air arising from them will cause the paper wheel to turn and the eyes will be alternately stoppered by the hanging shutter strips. The handle for carrying the toy is amply described by the pictures and needs no comment. One hour is a generous estimate of the time required to make it and if carefully fitted and adjusted it will last a lifetime.

PART IV

THE OUTDOOR BOY IN WINTER

CHAPTER I

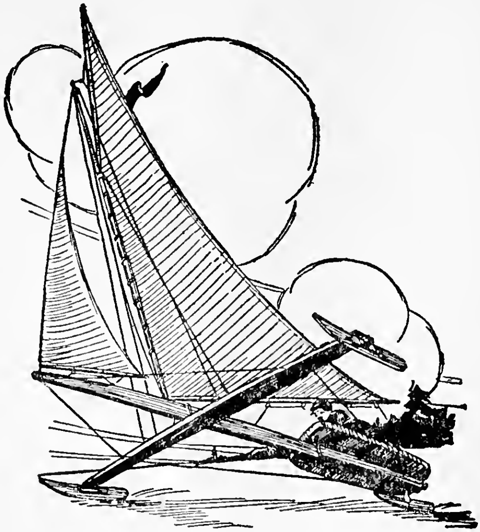
How to Build an Ice Boat

WHAT boy living near a river or lake has not longed in winter to own an ice boat? Such a craft is neither expensive nor hard to make. Here are provided directions for building and rigging an ice yacht which, if followed, will give you a craft that will be the envy of all your friends.

You can get a clear idea of the general makeup of an ice boat by studying the top view drawing, which is marked Fig. 1. The main parts are the long timber used as a keel or backbone, the cross-timber, and the runners. The backbone is a piece of white pine twenty-five feet long. It is ten inches deep or high in the center and tapers to three inches at both ends. Its thickness is four inches. It should be a firm, sound piece of timber, well seasoned and free from defects. The runner plank, two inches in thickness, is twelve inches wide in the center and ten inches at each end. It passes under the keel and is fastened to same by three "U"-shaped bolts, one of which is clearly shown in Fig. 13. These bolts fit down over the keel like a staple, their ends pass through the runner plank, and, being threaded, are bolted underneath same. This is the first bit of assembling we will do, and it will make the thing look so much like a real ice boat that we should feel encouraged.

The runners come next. They may be made in various ways, but for a boat of the class we are considering only the very best and strongest construction will do. The dimension and shape of the runner used is well shown in Fig. 4. The material used is

staunch, hard wood, preferably oak or maple. The cast iron or steel runner shoe is fastened on by five bolts which pass through the depth of the runner and then into tapped holes in the runner shoe. A sectional view of this is shown in Fig. 5. Note the shape of the running surface of the shoe and the depth that the bolt sinks into it. Figure 6 shows in detail how the wooden runner is secured to the runner plank. "A" is a bracket-shaped block screwed to the under side of the runner plank near the end. "B" is

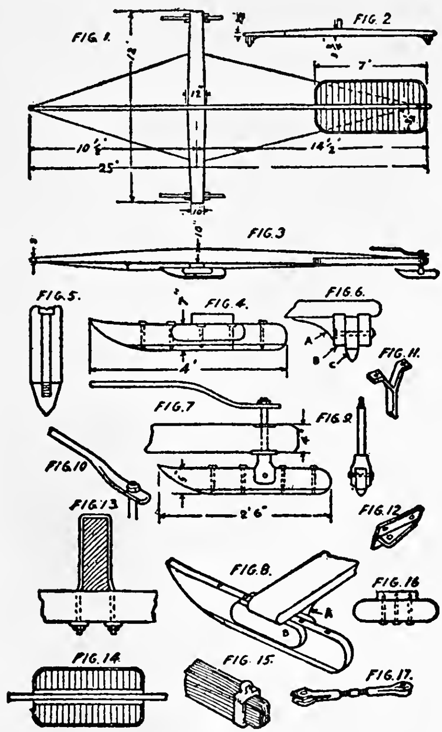


AN ICE BOAT.

a piece of scantling with rounded ends, as seen in the central part of Fig. 4, and bolted to the bracket. "C" is the runner which fits between two scantlings like "B." In putting the runner plank into its permanent position and also in bolting on the runners it is very necessary that accurate right angles be used. To maintain this true position, wire stays or braces are used. Certain metal fittings are used to aid in making a neat job of the wire work. Two spreaders, like Fig. 11, are used under the runner plank, one near each end. The double end is screwed to the under side of

the runner plank and the notch in the single end used to guide the wire. On each side of the keel near the rear end is a fitting like Fig. 12, used to fasten the ends of the wire. Figure 15 is a picture of the device used at the fore end of the keel.

In Fig. 8 we have a good detail picture of the runner construction, which I think will answer any question concerning same that

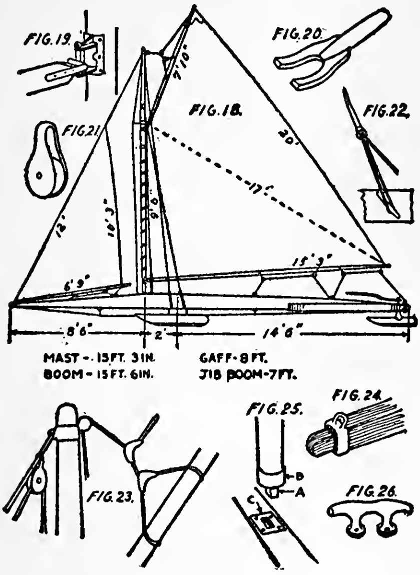


PLAN FOR ICE BOAT.

may arise. Figure 7 is designed to show the steering apparatus. Figure 10 is the helm or handle, by means of which the rear runner, which acts as a rudder, is operated. A front view of the bolt used as a post and the manner in which it is made fast to the runner is shown by Fig. 9. Figure 17 is a fitting for shortening ropes or wires used in various places in the rigging. Figure 14 is a view

of the under side of the decking which is at the rear end of the yacht, as indicated in the top view drawing Fig. 1. It consists of hard wood flooring, bound at the outside edges and supported by metal brackets.

Turning to the next group of sketches, we will consider the rigging. Hardly two people will agree as to the right way to rig any kind of boat, and the more experience they have the less chance is there for an amicable settlement of the so-called fine points of the game. I have adapted in this plan the ideas of an expert who has been an ice-boat enthusiast for many years, and who has rigged dozens of racers. Figure 18 shows a complete layout of the sail plan far more graphically than words could picture it. If you know anything about ice boats, you can grasp the idea illustrated. The detail sketches scattered around have the following signification: Fig. 15 is the fitting used at the point of contact between the gaff and mast. The mast is the large upright timber and the gaff is the small round timber marked seven feet ten inches long in the sail plan drawing Fig. 18. This fitting and nearly all the others mentioned will have to be secured at a store that makes a specialty of outfitting yachts. Wherever there is any considerable amount of the sport, such a store can be found. Figure 22, in the language of an amateur, is the end of a sail rope fastened to a cleat. The iron fitting used at the end is shown. Figure 20 is the cleat which permits the boom to swing around the mast. Figure 21 is a simple pulley block. Figure 23 is a detail



PLAN FOR ICE BOAT.

sketch of the rigging at the top of the sails. It may be closely followed. Figure 25 is the base of the mast and shows how it is held firmly in place. "B" is an iron band or ferrule to keep it from splitting. "A" is the squared end which fits into the square hole. "C" is a metal plate placed around the hole to prevent wear. Figure 24 is the fore end of the keel with its fitting for the wire. Figure 26 is one kind of rope cleat generally preferred by ice sailors.

The size of the spars is shown in the drawing. I imagine that these will offer greater difficulties to the amateur than any other part. It is quite hard to procure them in some sections of the country, and then again they must be such perfect pieces of timber that great care in selection is necessary. I always like tough, straight-grained hickory for rigging. Each stick is thickest in the center, the mast being four and one-half inches in the center and about three inches at the ends. The boom is about the same. The gaff and jib boom are about three inches in the center and taper each way to two inches or a little more. Several coats of the best spar varnish must be applied before the sticks are set up.

In the selection of canvas use the strongest, as it will no doubt prove to be the least expensive in the end. The advice of local men who know special conditions attending their territory is always helpful to the amateur. With the ideas gained from this article you can make an ice boat of a simpler and cheaper kind, but the one given here is for hard and continuous use. You cannot well reduce it in size unless the whole plan is changed.

Finish all wooden parts with varnish. Three or four coats may be applied with good returns. The first will be thinned one-quarter with the best turpentine. After that the subsequent coats must be thin, but not watery. Thorough drying between each coat is essential. Some people like to put linseed oil on wood for a first coat and then add paint or varnish. I have no objection to this method, and think that there may be parts of the country where it has some advantage over others. Again the advice of experienced local men will be of value to you.

CHAPTER II

All Sorts of Sleds

A DOUBLE RUNNER

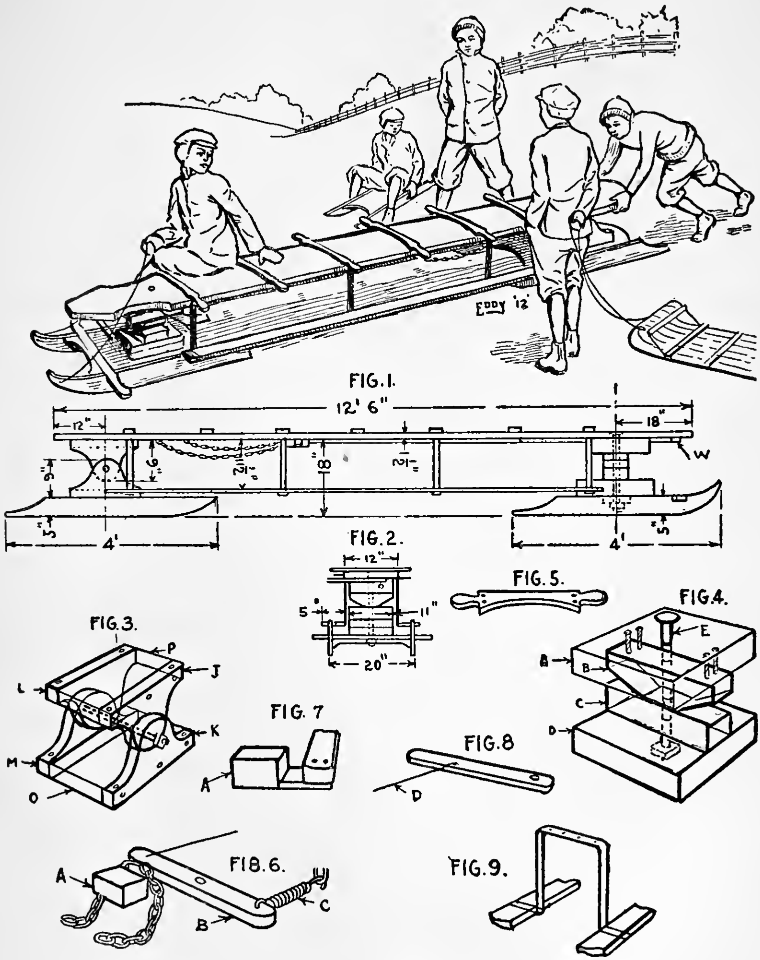
YOU will have to go a long way to find a better plan for a coaster than the one shown here. If you live where the snow flies and have any good hills close by, you should get your crowd together and decide to make this fine winter article.

Let us consider it just as you would a house, that is, begin at the foundation and keep in mind only one thing at a time. In this case the foundation is the two sleds which form the double runners. They may be purchased or made. It is probable that two of the gang can furnish those sleds. If you can only get one, make the other just like it. The sizes of the parts are given in the drawings.

The blocks placed on each sled to support the long plank are really the most important part of the work. Figures 3 and 4 are complete pictures of the rear and fore ends respectively. The main part of Fig. 3 is the four curved blocks. They are nine inches high and twelve inches long and are sawed out of sound two-inch plank. Cut the curves with a circle saw and finish with a draw-knife and sandpaper. Between the flat or straight ends of each pair is a square two-inch block of the same material. The curved pieces are securely bolted to it. In Fig. 3, "J," "K," "L," and "M" are the curved pieces, and "O" and "P" are the square blocks referred to. A one-inch hole is bored three inches below the center of the curved side in each, and through the hole is put a strong bolt. The whole arrangement as shown in Fig. 3 is bolted to the rear sled. The idea behind it is to permit the rocking of the plank.

The blocking for the fore sled is simpler, but no less important. All pieces are of two-inch plank. The lowest one or base is eight inches square, the one on that is two inches wide and eight inches

long. Those are marked "D" and "C." The third one, "B," is the same size as "C," but is tapered at the ends. The last one, "A,"



A DOUBLE RUNNER.

is a square block like "D." "E" is the large king bolt which fits through all, permitting the coaster to turn.

We will now get a sound plank twelve feet six inches long and cut it to the shape shown. Seven handholds like Fig. 5 are screwed on, being spaced about as shown. We must now get from a blacksmith four pieces of quarter-inch wrought-iron straps as pictured in Fig. 9. The long, narrow running boards are bolted to the short bends, while the top of the iron itself is bolted to the under side of the platform plank.

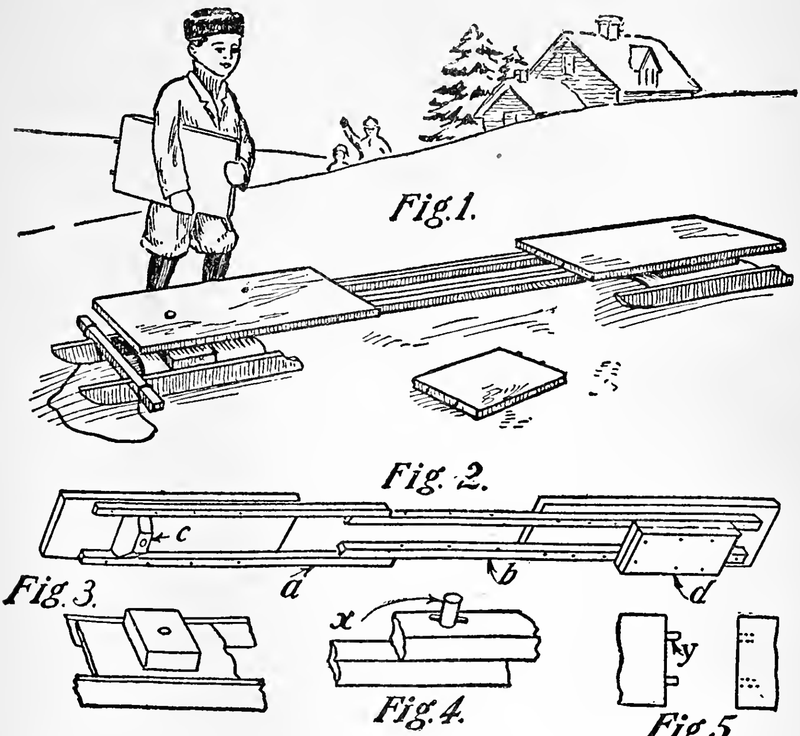
We now take up the idea for a brake pictured by Figs. 6, 7, and 8. You may omit those from the plan if you wish, but they are worth a trial. The brake consists of a chain with lever to release it, so it will fall in front of rear sled. All of the parts are screwed to the under side of the big plank. Figure 8 is the rearmost cleat over the center of the sled. "D" is a wire running to the cleat "B." The chain is fastened to the plank and the loop end hangs on "A," which is shown in detail by Fig. 7. "C" is a spring to give tension. When the lever Fig. 8 is pushed, by reason of the wire connecting it to "A," the latter is moved enough to let the chain fall. It will get under the rear runner and cause it to stop.

The painting is important both for service and looks. Use a bright red color and have some handy lad letter on a name or neat design. The cost and material needed depends on the locality and the amount of available stuff you can find around home.

A BOB-SLED

In coasting, you have no doubt felt that sometimes the bob was too long for the few that were there to ride, and at other times it was too short for the gang that wanted a chance at every trip. The sled shown in this sketch may be made longer or shorter as you desire. The device by which this is accomplished is simple and easy to make. Figure 2 shows it clearly. The 3 x 3" pieces "*b*" slide between pieces of the same size "*a*," and are locked by a peg which fits through holes bored in both. Figure 4 is a detail sketch of this locking peg and the slide joint. You may have two or three extra pieces of plank to fit into the space provided by this lengthening device. The extra lengths have dowels in the ends like a table leaf in an extension table. Figure 5 will leave no doubt as to what is meant by dowels and holes. The other parts of the bob-sled are quite as simple as it is possible to make them. Figure 2

is a view of the under side and shows every part. Notice the hole marked "C." A one-inch bolt fits into this and through the hole in the fore sled (Fig. 3). The head of the bolt is on the top of the fore end of the plank and the nut is under the front sled. The rear sled is screwed securely from its under side to the large blocks "*d*."



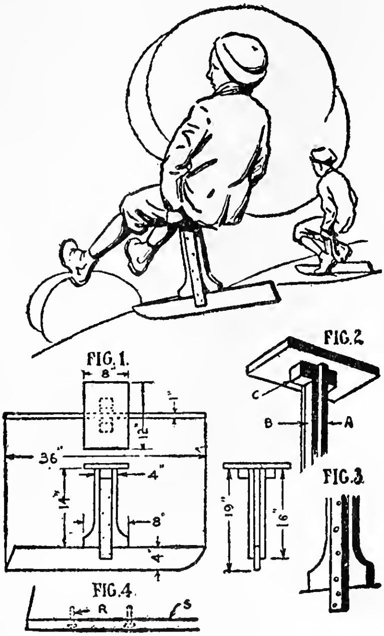
A BOB-SLED.

The steersman sits in front and holds the rope. With it and the footrest he is enabled to steer or hold a straight course. There is not much decoration possible in this sled. It is built for sturdy service and convenience. However, it must be painted, and you may as well adopt the flaming red and do a little striping if you can. Use two coats of paint and one of varnish.

THE SINGLE RUNNER

The single runner sled, of the type shown herewith, is fast winning favor among the boys of our Northern States. It is ridden something after the manner of a bicycle, and when once it gets fairly in motion it is quite easy to maintain your balance and steer.

Select for the runner a piece of pine thirty-six inches long, four inches wide, and one inch thick. Plane the board smooth and with



THE SINGLE RUNNER.

the aid of a coping saw round off the fore ends. Then saw off the rear end of the runners at an angle, as shown in Fig. 1. For the upright post procure a piece of pine fourteen inches long, eight inches wide, and one inch thick. The end of the post which is to be fastened to the runner should be cut as in Fig. 1. Now take two strips of wood two inches wide, sixteen inches long, and one inch thick, and fasten them with screws to each side of the upright post.

Note in the illustrations that they extend down below the post two inches and lap on to the runner, one on each side.

The seat is a pine block 8 x 12″ and preferably more than one inch thick. It is screwed to the post and strips and to two blocks, "C" in Fig. 2, which add strength and rigidity to the whole structure.

For an extra good job, you must reinforce the sliding surface of the runners with strips or shoes of steel. In putting them on, be sure to countersink the screw heads, that means to make them flush or even with the surface of the runner. If they stick up, even a little bit, they will retard the sled and dig into the snow or ice. A couple of coats of paint will give the sled a better appearance if it happens that you have used old pieces, and even if you have all new lumber it is necessary to make it last longer and keep from warping.

THE STRADDLE-BUG

Here is something for you and your friends to work on and enjoy together. It is called a straddle-bug, and few kinds of sleds can give as much genuine amusement and fun as this. You will note by the dimensions given that it is large and rather heavy. While there are very few pieces and consequently few joints, it is so designed that it is self-braced in every direction, and if properly put together will stand the roughest kind of usage.

The work of making it is so simple and the accompanying cuts so plain that there is really little to be said; but for the benefit of those who find it difficult to follow the drawings it will be made clearer: First get two long hickory poles for the runners or, if this is impossible, common scantling will do. Length, eight feet four inches. Saw notches in them front and rear to receive the slanting braces or legs as shown in Fig. 1. The braces are made of two pieces of scantling each three feet in length, ripsawed in the center. Lay the runners on the ground with a space of thirty inches between them, insert the braces in the notches you have cut, and tack them temporarily with wire nails. Now you can lay the heavy plank on the top and mark the exact places that the notches have to be cut in it. Saw those four notches to the required shape and depth and return the top plank to its place. It may now be screwed on with heavy two-inch wood screws, driven in a

slanting direction. Always bore a hole before trying to drive a screw into hard wood, making the hole as large in diameter as the thickest part of the screw shank. Dip the screws in lard before inserting them. Our next task is to bend the ends of the runners up so they will touch the front end of the top plank. They should be tapered nicely to a point and soaked in water a couple of days before attempting to bend them. The ends fit into notches and are fastened with screws. The two long center braces serve to strengthen the sleigh and are also used as a step to get on. They are notched and made fast with screws as in the case of the other

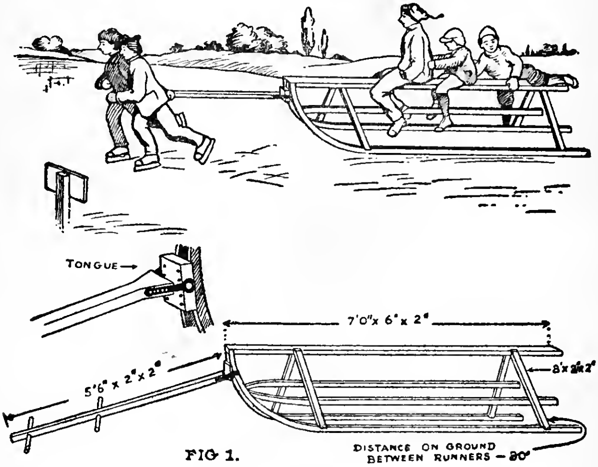


FIG 1.

THE STRADDLE-BUG.

parts. The front tongue or handle is the only part now to be considered. It is five feet six inches long and two inches square. The rear end may be broadened out as shown in the drawing marked "tongue." Fasten two iron straps to this broad end and pivot them to the large block which is nailed to the front end of the sleigh. The cross-bars of the handle explain themselves. Give the whole affair two coats of bright red paint, and when it has dried you are ready for the best time of your life. With a slight variation of the tongue, using two poles instead of one, you may hitch a horse or pony to the sled. Take it out on the ice, on the coasting hill, or country road and you will find it a winner.

A WAR SLED

Here is a war engine with which you can attack a snow fort. It consists of a large double-decked staging mounted on four sleds. If the blockhouse is built on the ice and you have one of those

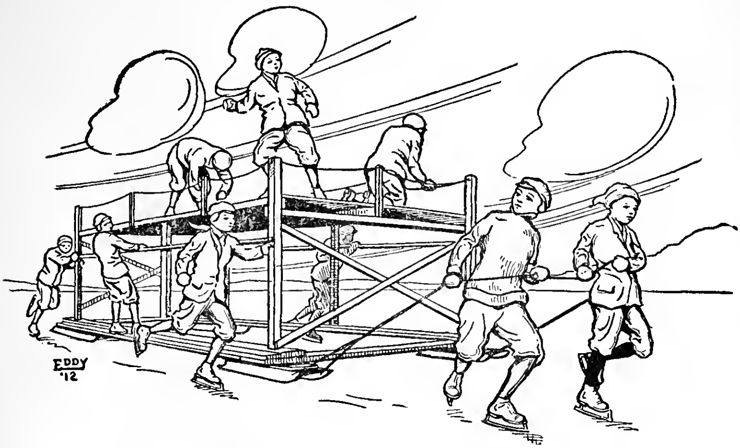


FIG. 1.

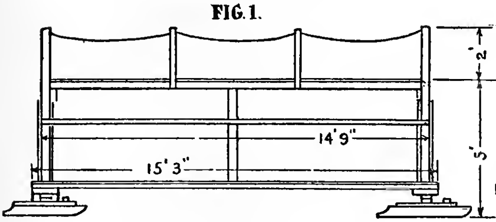


FIG. 2.

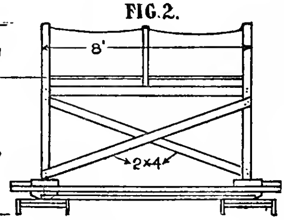


FIG. 3.

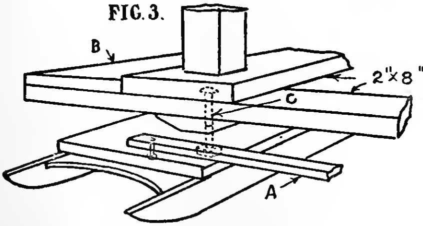
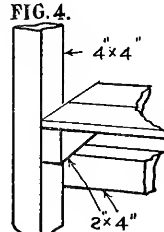


FIG. 4.



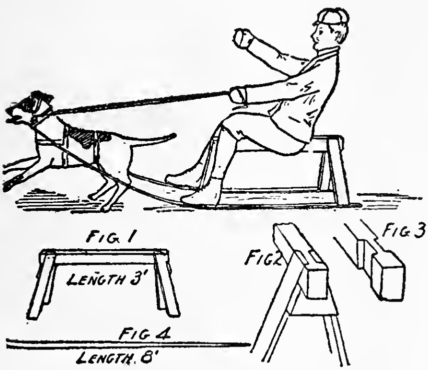
A WAR SLED.

juggernauts manned by a few dozen stalwart warriors, there is bound to be some fun and I would like to be close by to see the proceedings. The lads on the top deck hurl snowballs as they proceed and have every chance to scale the wall, although, it is true, they must stand the brunt of the fire from the fort's "guns."

The general dimensions of the pieces used in the construction of the car are shown in the diagrams underneath the picture. The first part of the work is to make a frame of planks and place a sled under each corner. Next erect the corner posts and the braces which hold them together. The top deck is then added and you are ready for action. There is nothing wrong about those imitations of ancient war articles; but undue roughness should not be indulged in. The lad who is ruffianly is generally that way wherever he gets the chance, whether it is in the parlor or on the playground. Treat your neighbor squarely, not because he is a gentleman, but because you are one.

A WINTER FUN MAKER

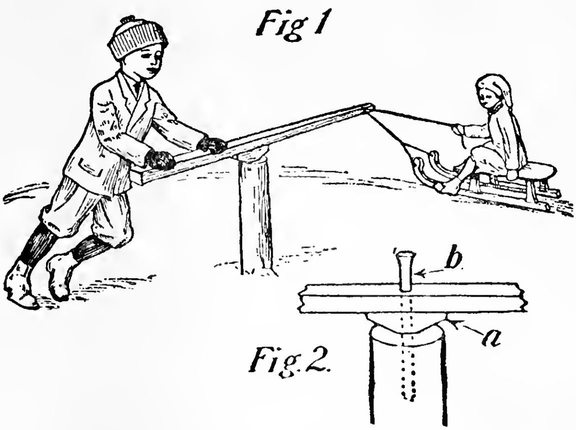
Here's a funny sled for you to make. Get a saw horse and a couple of long pliable poles. If you can get a sapling and split it, you will have ideal runners for this cold weather dog-mobile. Set the horse upon the split poles with the flat side up and screw them firmly in place. If they are long enough to reach to the animal's muzzle so much the better, if not, you can tie on pieces of rope. You will certainly make a hit with this kind of sled, and it will be no hardship on the dog either, for you can help by kicking back on the ground. You might use a pony for motive power or have a couple of friends pull you. At any rate, the plan promises some hilarious fun and you ought to get busy on it.



A WINTER FUN MAKER.

WINTER MERRY-GO-ROUND

Here is a cold weather fun maker copied from the Russian peasant's "gig." It can be used on a shallow pond or in a level field where the snow is beaten down hard. The first thing to do is to sink a post three feet into the ground. Tramp the dirt thoroughly and make the post firm. In the top of it bore a one-inch hole to a depth of at least eight inches. For the cross-piece at the top use the longest, toughest pole you can get. The longer it is, the more fun you will have, for each foot of length means over three feet in the circle. Nail a block on the under side for a bearing

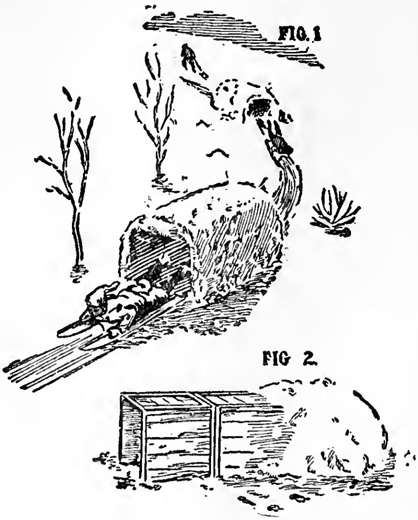


WINTER MERRY-GO-ROUND.

and bore a hole big enough for the bolt to pass through. Grease the hole well with lard or axle grease. The hole should be two feet from the hand end and about twelve feet from the sled end. Hitch the sled to the long end and let some one push the gig around. At first it will be hard sledding, but after you get going the momentum will carry you round at a dizzy rate. There is practically no expense incurred in making one of these whirligigs and no danger attends its proper use. As a rip-roaring good joy creator I recommend it.

TUNNEL

Here is a pretty little stunt for a snow-slide. The idea is to build tunnels of snow by first placing a large box right in the path of the down-hill slide, and then covering it with snow. This should be done when the snow is rather soft and wet. The next morning, when it has frozen and become firmly set, you can draw out the



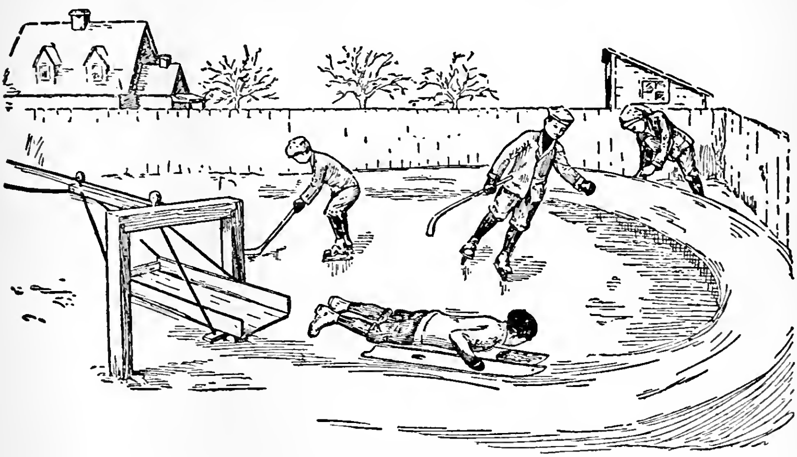
THE TUNNEL.

box, and if you have not piled too much snow on top, the arch will remain standing. If you have boxes enough you can leave them in, but that will make the dash through the tunnel more dangerous. Did you ever try a common barrel stave for a toboggan? Just get a wide, thick stave and sit on it, and if there is any down grade you will travel. Another stunt is to strap a stave to each foot and try to go down hill standing up.

CHAPTER III

Winter Sport in the Backyard

You will certainly not lack a means of enjoyment during the Christmas vacation if you convert the backyard into an amusement park in accordance with the directions given herewith. After you have read and comprehended the plan call a few of your friends in for consultation and decide whose yard you are going to use. The one that affords the most space should be selected.

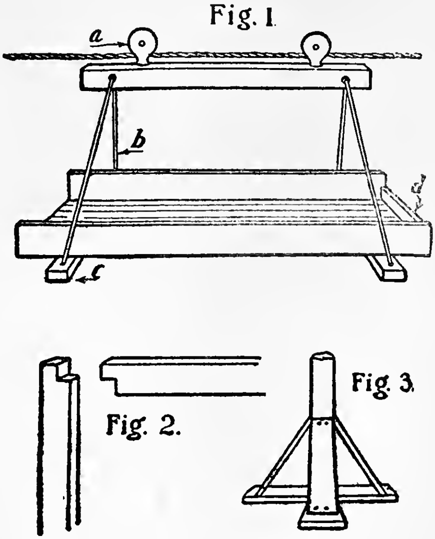


WINTER SPORT IN THE BACKYARD.

City lots are usually thirty feet or thereabout in width, and as for length, you will be lucky if you find fifty feet unoccupied. Get busy and level off an oval space of these dimensions, banking up dirt and snow to form a saucer track four feet wide and three feet high at the outside. This must be carefully packed and frozen, so that the water with which the enclosure is to be flooded will not seep through. It is best to have the saucer track made and tested

before you do the flooding. Select a cold night and sprinkle water on the track, besides filling the pond to a depth of three inches.

The second part of our plan is a toboggan made on a new principle. Instead of coasting down a hill we roll down a rope runway. This simple device is shown in the complete drawing. The only part not visible there is the high post to which the other end of the rope is attached. Let us first consider the runway apart from the rest of the plan. It consists of three parts, the first a heavy wooden



PLAN FOR TOBOGGAN.

frame, the second a post, the third a rope which connects the two. The frame is made of 4 x 4" timbers, joined as shown in Fig. 2. When finished they extend four feet over ground, and are deeply enough imbedded in the soil to make a firm support. A good plan is to nail braces to the lower end of each post, as shown in Fig. 3, and sink same into the ground. Understand it rightly, all the parts shown in Fig. 3 are underground. When dirt or concrete is packed upon the extending braces it holds the upright post firm as a tree is supported by its roots. The single high post is

treated in the same way. It should be twelve or fifteen feet back of the arch and high enough to give a fall of two inches to the foot. Heavy wire cable is used for the runway. The carriage is clearly shown in Fig. 1. It should be a little longer than a common sled. The top part is a sound piece of scantling suspended by the pulleys "*a*." At each end a one-inch hole is bored in this piece, through which pass cable to support the underpieces "*c*." The flat strongly built platform "*d*" is the part upon which the sled is placed when ready for a slide down. The fore end is the pulley "*a*," the rear is the cross-piece "*d*." Here is the way the skidder is used: One boy holds the guy rope which is attached to the rear part of the carriage, while another places his sled upon it and mounts the same. His position is face down with feet hooked over the rear of the carriage to hold himself on. At a signal the guy rope is released and down slides the sled. When it gets near the end the boy raises his feet, the pulleys bump the cross-piece of the heavy arch, and he is projected forth at some speed. If he has his wits about him and steers right he will circle the track once or twice before he comes to a full stop.

CHAPTER IV

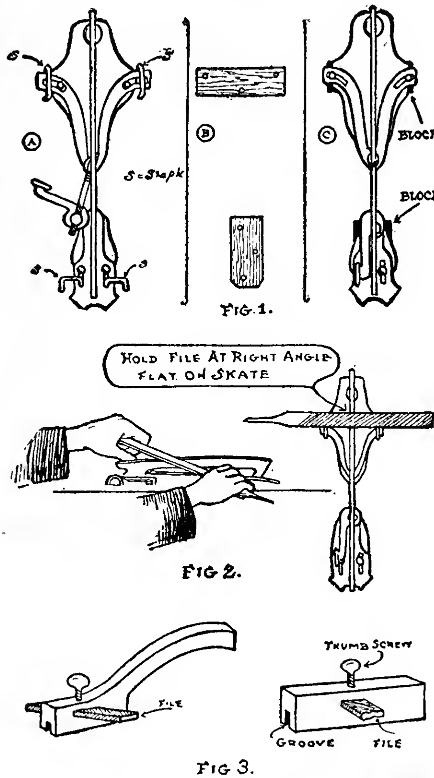
The Boy Skater

SHARPENING SKATES

FEW boys understand the art of sharpening skates. Most of you will grasp the file and rub across the runner, thereby making the getting of a true bevel most difficult if not impossible. The right way to go about it is to secure the skate firm and rigid in a vise, grasp the file with both hands as shown in Fig. 2, and draw it up and down the full length of the runner at each stroke. Remember the file is held at right angles to the skate, but it is not pushed crosswise; it is drawn lengthwise as if you were paring with a draw-knife. If you have no vise you may fasten the skate to a bench with staples as shown in "A," Fig. 1, or with the aid of two blocks, shown in "B," Fig. 1, you may nail it fast with common nails as illustrated in "C," Fig. 1. The beauty of this plan is that you do not have to buy a single thing or go to any trouble to procure apparatus. The file should be a flat one-inch rasp about a foot in length.

In Fig. 3 we show a device which may be called a home made skate sharpener. The one shown on the right of the cut is the simpler. It consists of a hard wood block one inch square and six inches long, into which has been cut a groove large enough to receive the skate runner. Through the center of the block and at right angles to the groove an oblong hole is bored, and into this a piece of file is inserted and held firm by a thumbscrew that comes down through the top of the block. A glance at the drawing in Fig. 3 will make this very plain to you. If this sharpener is accurately made it dispenses with the use of a vise. You simply place the skate runner into the groove and holding the skate with one hand push the sharpener back and forth with the other, with the same motion that a carpenter uses a small plane. In reality, you

are planing the skate. The drawing to the left of Fig. 3 is another adaptation of the same principle. It is neater and more mechanical looking and at the same time a little more difficult to shape out.

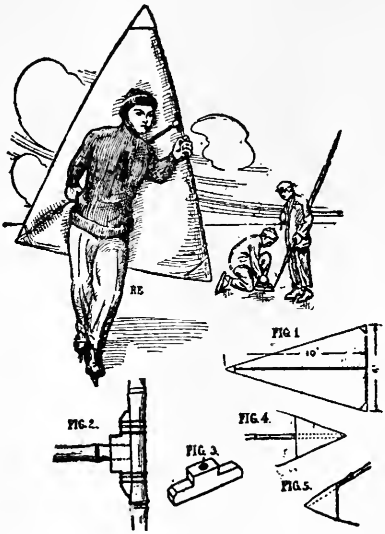


HOW TO SHARPEN SKATES.

With the aid of either one any amateur can sharpen his skates properly, for the file holder also serves as a gauge. Another advantage is that it may be carried in the pocket, so that you may sharpen your skates at any time and place you wish.

SKATING SAILS

When all is said and done, skating is the most glorious sport of all, and with the addition of this sail it becomes an almost divine glide. You can skim along thirty miles an hour with a sail, you can tack against the wind with it, you can steer with it, you can sneak in behind another fellow sailor and shut off his supply of wind, and then, when he kicks, you can get out of his way and race him.

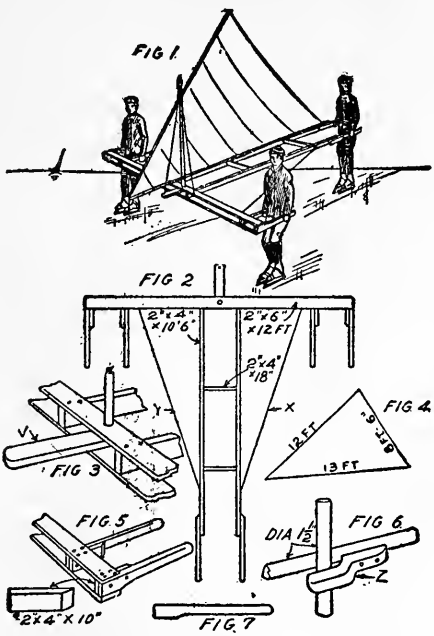


SKATING SAIL, NO. 1

Get two bamboo or cane rods, one eight or ten feet long and the other six feet long. Out of a piece of scantling two inches thick and four inches long cut a block like Fig. 3. The hole in its center should fit the small end of the longer pole. The block itself is fastened securely to the middle of the shorter pole as in Fig. 2. Fit it as shown and then measure the size of the triangle that would join the corners. This will be the size of the canvas required. The canvas must be of good quality and waterproof, but must not be too heavy. Hem it all along the edges and sew on a pocket at each corner. The six feet edge is now sewed with heavy cord to

the shorter pole. Slip the longer pole into place and you are ready for some fun. In carrying the sail to and from the pond slip the longer pole out of place, lay it alongside of the other, and roll the canvas around both.

There is another skating sail which is superior to the first because more than one boy can use it at a time. In use it is a sail, manned by three instead of by a single person, as in the case of the common



SKATING SAIL, NO. 2.

type; in appearance it is an ice yacht, and differs only in the fact that instead of using steel runners permanently fastened to the framework, three steel-shod boys are used. And they are the boys that will have rare sport. It is hard to imagine anything more exhilarating than a speedy trip before the wind with one of these sails.

The construction of the frame is simple work. The drawing il-

lustrates every part of it, but a few hints will not be amiss. First, you may have six boys instead of three, by putting two at each point; second, when your framework is complete you can put runners on the points and you will have a regular iceboat. From this you will see that the plan covers a wide scope.

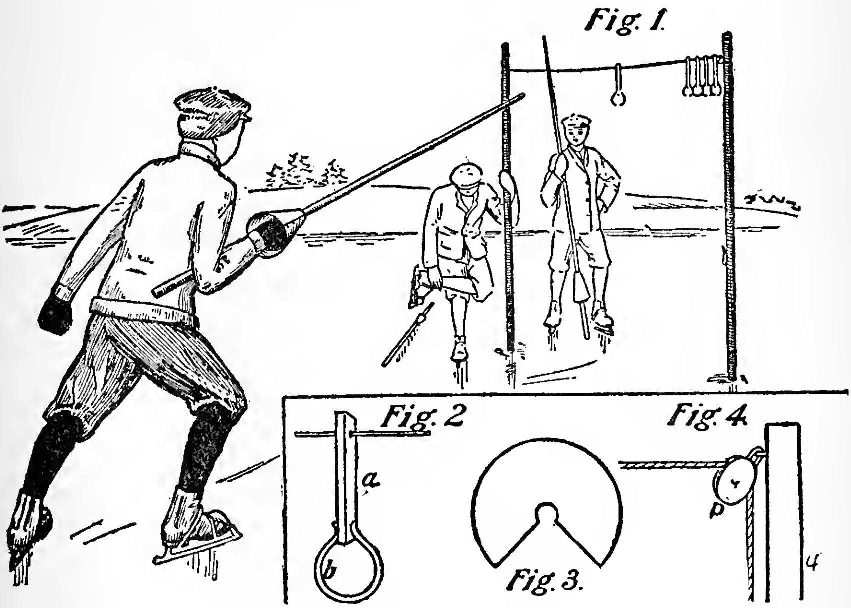
First get two scantlings ten and a half feet long and lay them out parallel with eighteen inches of space between them. These, when connected with two braces eighteen inches long, will form the long central part. To the front ends of these long pieces spike two pieces of two-inch by six-inch stuff twelve feet long, one of them on the top and one on the bottom. Figure 3 shows what is meant by this. On the extreme right and left, and between those double pieces we now place our handles. The full plan of the handles is shown by Figs. 5 and 7. Our next step is to brace the frame by putting in the wires "X" and "Y" as shown. We have now made ready for the mast and sail. From experience I know that much difference of opinion obtains as to the proper way to rig a sail. I have used the simplest method that I know of. If you know a better way use it and tell me about it. Our mast will be about eight feet high. A hole is cut to receive its base, while three wire stays leading from the top suffice to make it steady. The shape and dimensions of the sail are shown in Fig. 4. Along the base of the sail is a long light pole. It swings around the mast by means of the cleat "Z" shown in Fig. 6. A pole also runs along the top of the pole. This about completes the job. Of course paint will make it look better and at the same time preserve the wood from cracking.

In order to be safe we have used pretty heavy lumber in our plan. You can reduce all the proportions if you wish. In conveying the sail overland or against the wind, roll up the sail, grasp the frame by the cross-arm, letting the rear handles drag. In like manner, when you are going fast and wish to stop, the rear boy drops his handles and the dragging will act as a brake. The rear man or two, if there be two, work the sail and do the steering. The steering is done simply by pointing the feet in the direction you wish to go.

CHAPTER V

A Winter Tilting Game

THERE are many old-time games played on the ice which lend zest to the sport of skating, but some of them are very rough and unruly. "Land-lubber" and "Crack-the-whip" are all right if you have a whole lake to yourself, but otherwise they encroach



A WINTER TILTING GAME.

upon the rights of others. The game about to be described is a test of both skill and nerve, and yet the best player need not be the biggest bully, as in the case of most of the ice games. Neither

will you, in indulging in this sport, be interfering with the rights of others.

The apparatus needed consists of an arch from which wire rings are suspended and a tilting stick for each player. The arch is made by sinking two poles into the ice. In a shallow pond they may be easily driven down into the ground, but on a deep lake or river they are set into holes bored in the ice and properly braced until they have a chance to freeze in. Another method is to use a wide heavy plank as a bottom anchor for each pole. At a height to be agreed on by the boys competing in the game a line is stretched across from pole to pole. The line may be secured as shown in Fig. 4. Short pieces of lath or shingle are threaded on as shown by "*a*" in Fig. 2. The ring consists of a piece of spring wire attached as shown by "*b*," Fig. 2. The stick used may be a broom handle tapered at one end. A tin shield is nailed on near the hand end. Figure 3 shows a pattern for cutting this shield. Now for the rules of the game.

Each player starts from the same line and while going under the arch at full speed must spear a ring. To prove that he is going at a good pace he must slide 100 feet after spearing the ring, without any effort to propel himself. It is easy to pick off a ring going slowly, but if the player does not glide along to the 100-foot line beyond the arch he must put the ring back, and forfeits his turn.

Each player gets twenty chances, and the one who picks the most rings wins the game. There are other ways of scoring, but this is perhaps the simplest and best. Ten players may divide themselves into two teams of five each. In this case the members start alternately, say about forty feet apart, and whirl along in riproaring, lively fashion. An umpire must be appointed to decide all plays. In choosing sides try to equalize the talent on both sides.

CHAPTER VI

Skees and Skeeing

Running on skees, or "skeeing," as it is called, is a sport that many boys of the western mountains indulge in each season with great vigor and delight. To many, especially those boys employed in mining camps as carriers and roustabouts, skeeing is not a sport, but a matter of business. It is a very swift method of

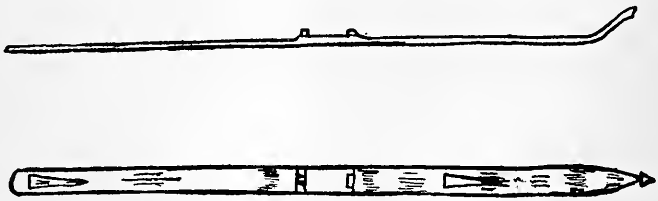
A BOY ON SKEES.

getting over snow-covered ground, especially on routes or trails that are favored with slopes and declivities.

The skee is not a snow-shoe, though it resembles it, and in some respects is a substitute for it. The skee is much easier made than the snow-shoe, since it does not require the intricate bending of wood fibre and the lacing and sewing of rawhide and leather. The

skee is all wood, with the exception of the straps used to hold it to the foot.

To make a pair of skees one needs to get two very tough pieces of wood, and shape them into the form of runners. They are made all the way from five to ten feet long, but the average boy requires them about seven feet in length. If they are made too long they are cumbersome, and are dangerous things for the beginner to mount, since they are more liable to get crossed. Laurel or ash, well seasoned, is a splendid wood with which to make a pair of skees. They should be made about an inch or an inch and a half thick in the middle, but thinner toward the ends; also, they should be fully an inch wider than the sole or shoe of the user, and turned up in a curve at the front. This curve is best secured, as is done in shaping sled runners, by first thinning down the skee,



AS A SKEE APPEARS FROM THE TOP AND FROM THE SIDE.

and then steaming the end at which the curve is desired, setting it in a vise or frame and holding till seasoned; when released the curve will remain firm. Heel blocks are placed at the center, on which to set the foot, and the skees are held secure by straps over the toe and foot and around the ankle. The skees are carved and ornamented to suit the individual taste of the owner.

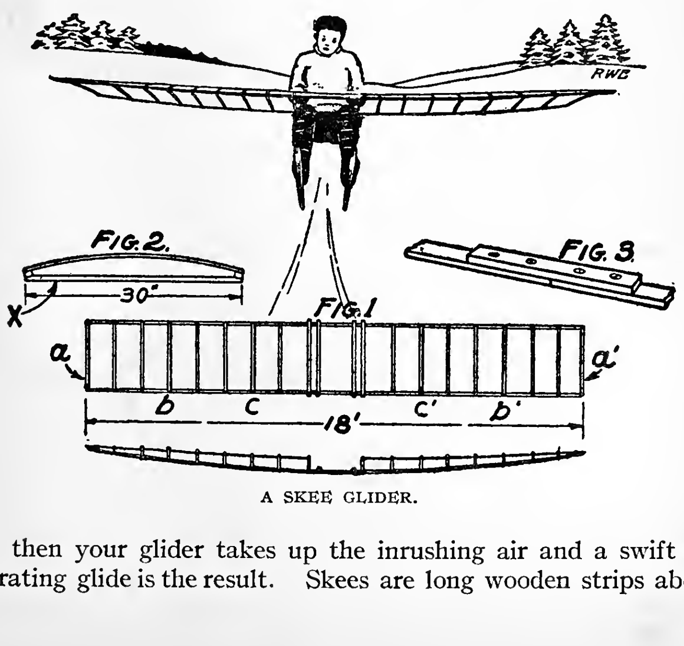
The beginner will do well to secure the skees to his foot in such a way as to be readily shaken off in case of accident. The skee pole, used for balancing and guiding, should, like the skees themselves, be made of very tough wood, and should be slightly pointed at the end. A long gradual slope, on which the snow is not crusted or is not too soft, is the best place for the amateur to make his first trial on skees. Place the skees parallel, and about one foot apart, hold the knees rigid and firm, and bend the body slightly forward. Grasp the skee pole firmly, and hold it in readiness to balance the

body, and also to steer. By holding the pole against the knee, and letting the end drag the snow, so as to prevent gaining undue speed, the beginner can soon learn how to manipulate the feet and ankles to keep the skees the right distance apart, and also to keep them pointed the right way.

No boy or man either can mount a pair of skees and run off on them the first time without trouble. The beginner can always be depended upon to afford considerable amusement for those who are fortunate enough to see him make his first trial. Try as he may, one skee will be sure to take one direction, and the other another, which must soon result in the user being piled in a confused heap in the snow. But after a few trials the trick is learned, and the real sport of the thing can then be appreciated.

A SKEE GLIDER

Here is something of a thriller. Equipped with skees, or the new broad runner snow skates, you skim along and take a leap from a



A SKEE GLIDER.

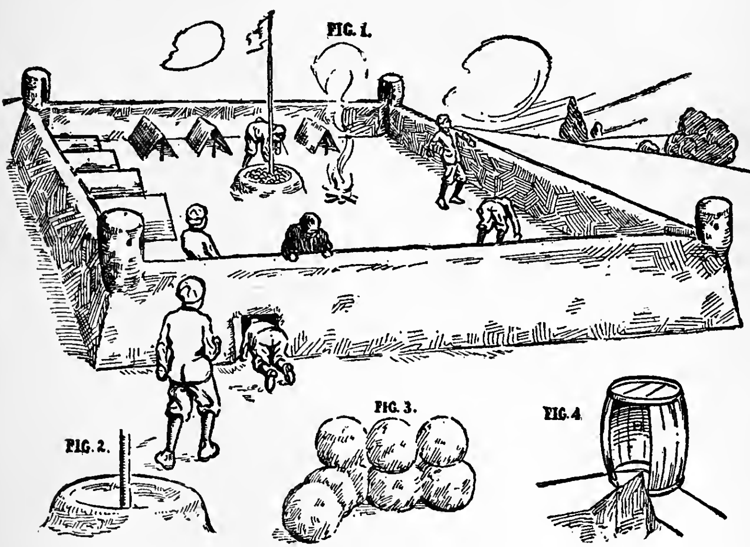
hill, then your glider takes up the inrushing air and a swift exhilarating glide is the result. Skees are long wooden strips about

3 x 46″. They are tied to the feet and are used to glide over ice or hard snowy surfaces. In Norway and Sweden, Russia, Canada, and other snowy regions they are very popular. The runway upon which the leaping contests are held is very carefully prepared and takes a sharp rise toward the end; this gives the runner impetus and he soars far out over the edge of the bluff into a deep snow bank. At the national meet in Norway a few years ago the winner leaped a distance of 170 feet. If he had had a glider it is probable that he could have gone twice that distance. The glider pictured here is made of bamboo poles, 18 x 30″. Make a strong light frame by putting a cross-brace every foot, using lighter pieces of bamboo for same. Strong canvas is then sewed over all the frame except the very center. This is left open for the runner to step into. The canvas is bowed by placing twenty eight-inch braces, "*b*," "*c*," "*c′*," "*b′*," as shown in Fig. 1. It is the simplest form of glider. You will soon learn to use it to advantage. A tilt upward of the fore end makes the glide longer, and this is accomplished by shifting the feet. Be sure that the spot you alight on is covered four or five feet deep with snow. In localities where this scheme can be used it will easily surpass other winter sports. I would certainly like to hear from you if you try it out. There can be no danger to it, for the people of northern Europe take those tremendous leaps without any glider or anything else to break the fall.

CHAPTER VII

A Snow Fort

THE picture suggests a rather elaborate snow fortification. It is patterned after the old-time blockhouses in which the early settlers took refuge when harassed by Indians. Mark off a square about twenty feet each way and make the base of the wall four feet wide. At the point desired a large box with open ends



A SNOW FORT.

may be built over for gateways. One of these is shown near the left-hand corner. The wall is built by piling the snow up in an irregular heap and then trimming it down even with shovels. If built against the wall of a building only three sides will be required. The dog tents, or small shelters, shown on the inside are

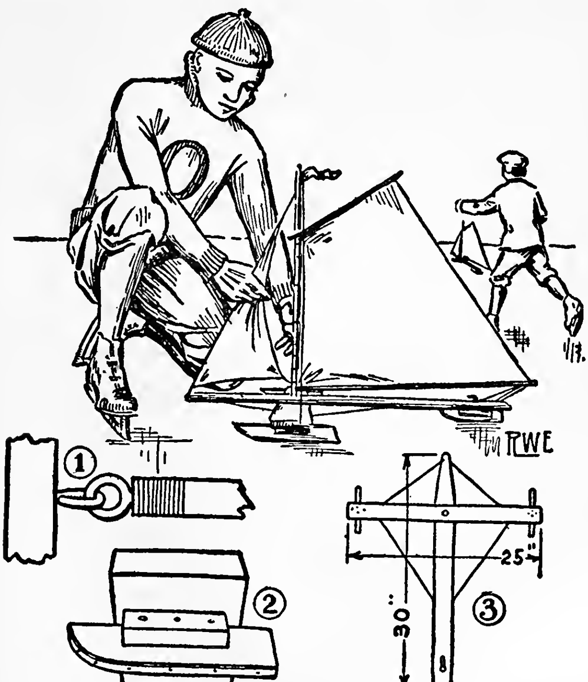
blankets erected on two poles. The flagpole is set in a pit in the center, so that it may be seen for a great distance. Raising the flag is a sign of battle, and lowering it, of surrender. The watch-towers on each corner are barrels built in as shown in Fig. 4.

The plan, as given, will furnish a good deal of harmless sport, but it may be greatly elaborated on.

CHAPTER VIII

Miniature Ice Yachts

BUILDING miniature ice yachts is a fascinating sport. You can use your originality and best skill and can experiment along new



A MINIATURE ICE YACHT.

lines. The beauty of it is that after spending weeks making a model, you can test it out and learn where it is defective. If you

intend to build an ice boat this winter there is no better way to learn the little kinks thoroughly than to go ahead and build a model and test it thoroughly until you are satisfied that it is as near perfect as possible. Then, with the pointers you have gleaned, you are in a position to go ahead and design a man-size boat that will be of worth. The model I have chosen is a simple one. Figure 3 shows a top view of the framework. Use one-inch pine pieces four inches wide. Use the same material for runners, and here it is well to observe that the runners of an ice boat are square and flat and never rounded, as that would permit it to skid sideways. A strip of tin or an old tub hoop may be nailed to the bottom of the runner. To step the mast erect a stick cut from a common broom at a point over the joint where the planks cross. From this mast both sails are swung, the bowsprit in front and the mainsail in the rear. The stick at the lower edge of the sail is called a boom. This is permitted to swing back and forth by means of two rings. The end of the boom and the ring into which it fits is shown in Fig. 1. Figure 2 shows a simple way of nailing on the runner. Make one of those models and set it going on some good ice. It will give you a merry chase. The plan in the main is good for any size ice yacht. If made larger steel skates would replace the pine runners.

BOOK II

PART I

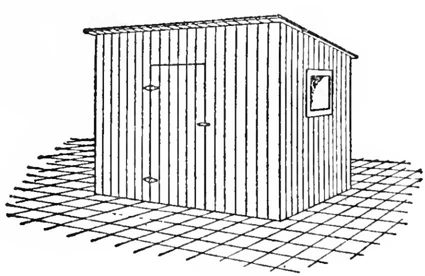
THE INDOOR AMERICAN BOY

CHAPTER I

A Boy's Workshop

EVERY boy needs a workshop all his own. He wants a place where he can hammer and saw and plan and invent, with nobody to bother him. Here, then, is your workshop. It will require little room and less money to build.

The building will consist of five parts—two sides, two ends and a roof, besides a door and two windows. First level off a piece of



A BOY'S WORKSHOP.

ground nine feet wide by twelve feet long. The pieces of timber which rest on the ground are called sills, and for your shop you will need one piece four inches square (called 4 x 4) fourteen feet long and two pieces of the same size ten feet long. Square off the ends of these timbers to these lengths and with a rule measure seven feet from one end of the fourteen foot timber, mark with your square and saw in two. You will then have two seven foot lengths.

Mark off four inches from each end of all four timbers, square across on top, half-way down on the sides and across the ends, as in Fig. 1. Saw to these lines and the ends of your sills will look as shown in Fig. 2.

On the ground you have leveled off lay the ten foot sills parallel to each other and six feet four inches apart, and on them, at either end, lay one of the seven foot sills, fitting the joints as shown in Fig. 3. Use your square and shift the pieces until the sides and ends are perfectly square, then spike together with 20d nails. To secure a good bearing, dig out for and slip two bricks under each corner of the frame, raising or lowering as required until level, as proven when the bubble of your hand level remains in the center of the tube in all positions. Next cut your corner posts from four by fours fourteen feet long. Square the ends to length as you did your sills and mark off six feet six inches on each stick for your back posts and make a square cut. This will leave the two front posts, which will be seven feet six inches long. Stand the posts on the sills, keeping them flush with the outside of the frame, and toe nail in place to the sills with 20d (twenty penny) nails, using the level or square to prove that they are truly vertical to the sills. To facilitate holding them in place, short boards, called stay laths, can be tacked to each post until the corner braces, which you will now cut from two two by fours ten feet long, as shown in Fig. 4, are fastened to posts and sills, two at each post.

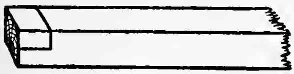


Fig 1

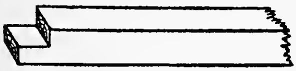


Fig 2

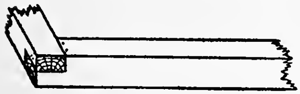


Fig 3

You are now ready for the two pieces, called plates, which carry the roof boards and rest lengthwise of the building on the corner posts. These are two two by fours, nine feet eight inches long, set on edge, placed and nailed so as to lap two inches on the posts, and leave two inches for the pieces, called end rafters, which you will cut from two two by sixes as shown in Fig. 5. Fit and nail the end rafters to both the plates and the posts, and between them nail a two by four to nail the roof boards to, keeping the top of

this piece flush with the top of the end rafters. Seventeen inches in the clear, each side of the centre of the front of the building, set a two by four, called a stud, extending from the sill to the plate, and six feet from the sill set in between the two studs a piece of

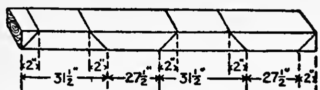


Fig. 4

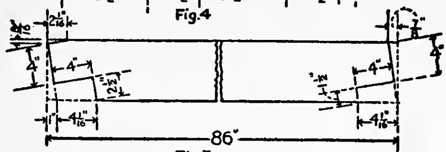


Fig. 5

two by four, thirty-four inches long, and nail into place. This makes your door opening.

In the rear of the building set a two by four extending from sill to plate, half-way between the corner posts. Four feet from the sills on all sides nail a dressed two by four except at door.

Cover your roof with matched roof boards, six inches wide and three-quarters inch thick, eight feet long, allowing boards to project over the front of building six inches and three inches over the ends. Cover the outside of the building with six inch dressed, matched roof boards or three inch beaded ceiling extending from the bottom of the sills to the roof, leaving one inch free all around the door opening and an opening eighteen by twenty-four inches in each end for your windows just above the two by four. With finishing nails cut a one-half inch quarter round around the openings or make a frame of $\frac{1}{2}'' \times 3''$ pine seventeen by twenty-three inches, inside dimensions, which nail over opening, leaving one-half inch all around to hold your glass. Set your glass, which

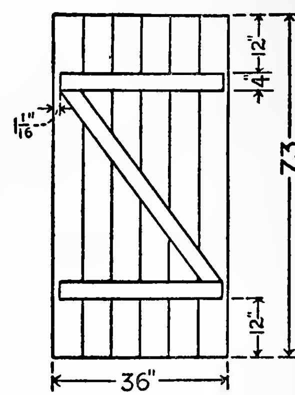


Fig 6

should be double thick, into place and secure in place with a strip one-quarter inch thick and one-half inch wide, nailed around opening on the inside.

Your door, which will be an ordinary battened door of the same kind of boards used to cover the sides of the building, as shown in Fig. 6, should be hung on two strap hinges. Make the battens of dressed 1″ x 4″. Paint the roof and outside of your workshop and fill in between the sills on the inside with clean dirt, tamping it well, and your shop is ready.

The first thing you will need inside will be a work-bench, which we will build across one end of the building. Take a dressed hardwood plank 12″ wide, $1\frac{3}{8}$″ thick, fourteen feet long, and cut into two seven foot lengths. Lay these side by side, keeping the ends even, and fasten together with three hardwood cleats $1\frac{1}{4}$″ x 4″ x 12″ long; one flush with each end of boards and one in the centre, screwed to boards with No. 14 wood-screws $2\frac{1}{4}$″ long, six in each cleat, keeping the ends of cleats four inches from the back and eight inches from the front of boards. Cut out a block four inches square from the two back corners to fit around the corner posts of building. Cut four pieces of 4″ x 4″, twenty-eight inches long, and four pieces of 1″ x 6″, twenty inches long. Twelve pieces in the clear from the corner post and on the front and back sills, nail one of the 4″ x 4″ and to this and the corner post nail one of the 1″ x 6″ strips, keeping the strip level and even with the top of the 4″ x 4″. Take the remaining two pieces of 4″ x 4″ and nail together with the 1″ x 6″ pieces, one on each side, even with the top ends of the 4″ x 4″. Lay your bench in place and you will find that the cleats drop into the pocket at each end. Under the centre cleat set the legs you have last made and fasten the back leg to the end sill of your building.

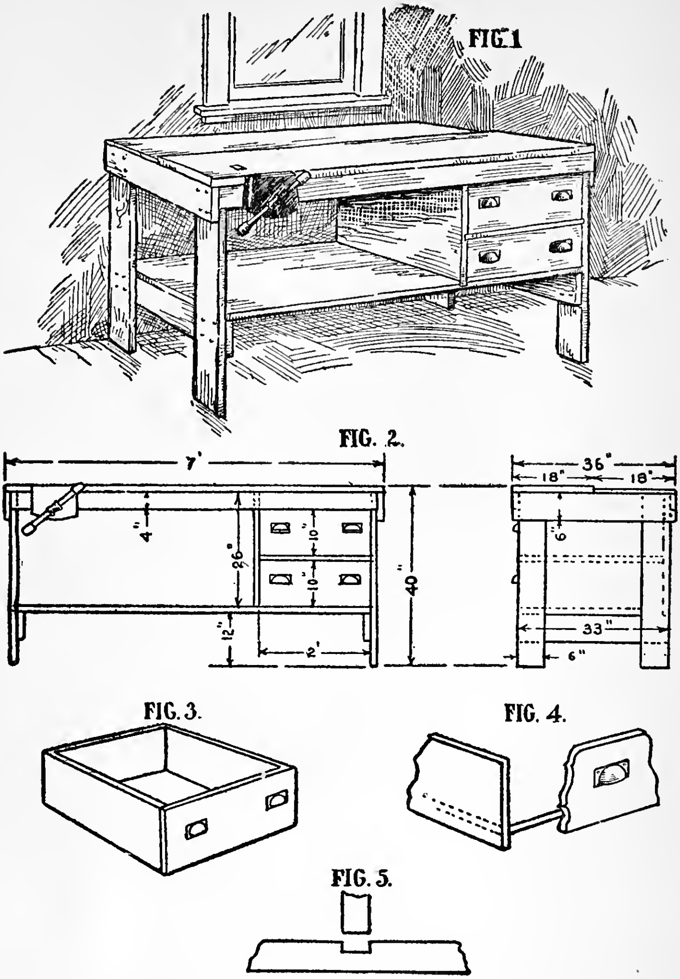
CHAPTER II

A Work-bench

EVERY boy craftsman should have a work-bench. It is not only a great aid in constructing things, but it is a standing invitation to work. While you are about it you might as well make a bench that will do for all time. The plan shows one that will prove strong and serviceable. Two large slide drawers provide a place for keeping your tools, while the shelf will be useful for the same purpose while a job is in progress. Figure 2 presents a side view and an end view of the completed bench. For the legs you will need four pieces of 2″ x 6″ stuff 38″ long. Fasten each pair together by means of a crosspiece of the same material, whose top edge is 12″ from the floor. Even with the top of each pair fasten a brace of like size. We now connect the pairs by putting in the lower shelf of 1″ boards.

The compartment for the drawers is now built, the joint used being like the one shown in Fig. 5. The drawers are made of 1″ stuff. Figure 4 shows the plan of construction. Make them so they will slide freely, permitting them to be too loose rather than too tight. The handholds may be purchased at a hardware store or a department store. Log scantlings are now nailed so as to connect the legs at the top, and next the top is put on. Our picture shows that one half of the bench has a top which is 2″ in thickness, while the other half is only 1″ thick. It will be better if it is all 2″ thick, but it will cost more. The bench vise is a simple one and may be purchased for sixty cents. A square hole is chiseled in the top of the bench near the vise end. This is to provide a stop or buffer for boards while working. Tight-fitting pegs are put into the hole for this purpose.

It is important that the bench be located where the light is good. Also see that all drafts are stopped. A nice, clean barn or the south window of an attic would be a good place for the

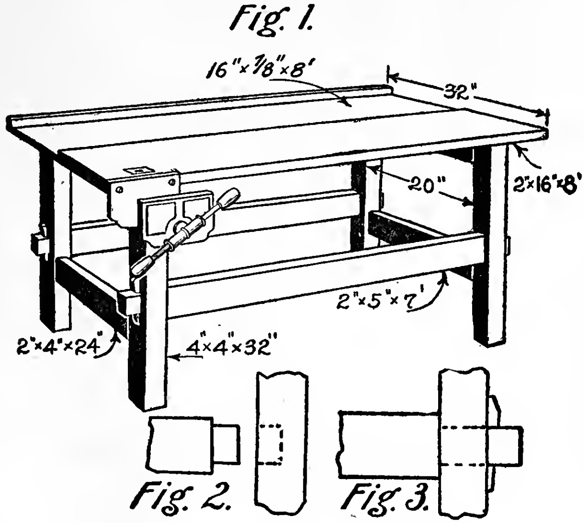


A WORK-BENCH.

bench. The idea, though simple, is well worth being put into practice by any boy. If you have no work-bench, you should make this one without delay.

A SMALLER WORK-BENCH

The type of bench treated here is very common and easy to make. The figures on the drawing show the exact size of each piece used. Figure 3 shows the joint used to fasten the long braces to the legs, Fig. 2 indicates how the short braces are secured. The purpose



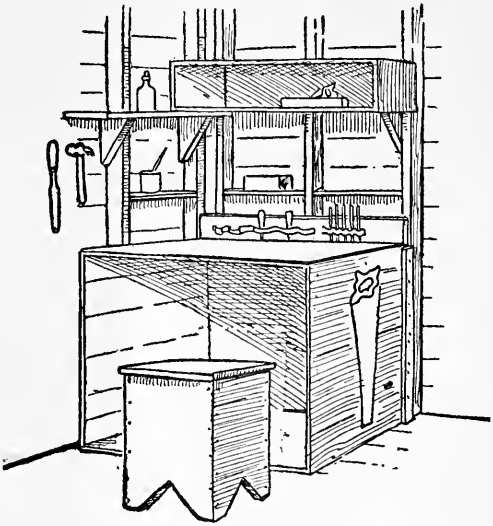
A SMALLER WORK-BENCH.

of the sketch is to give you the proper proportion to follow. You may have both of the top planks of uniform thickness if you wish, but it is not necessary.

A WORK CORNER

Here is a suggestion for a work corner in the barn or cellar. It may be you haven't room in your yard for a regular workshop, or possibly father won't let you build one; surely, however, he won't object to giving you space in the house for this. It serves a two-fold purpose. By its constant presence and readiness it invites you to work, and when the decision is made it affords a good place. The first thing to do is to set up a couple of large shelves on brack-

ets, and between the scantling tack four inch boards, which will serve as small shelves. A large box, reinforced by a double top, will do for a work bench. With a work corner like this, good, honest, beneficial occupation for the live, growing boy is always



A WORK CORNER.

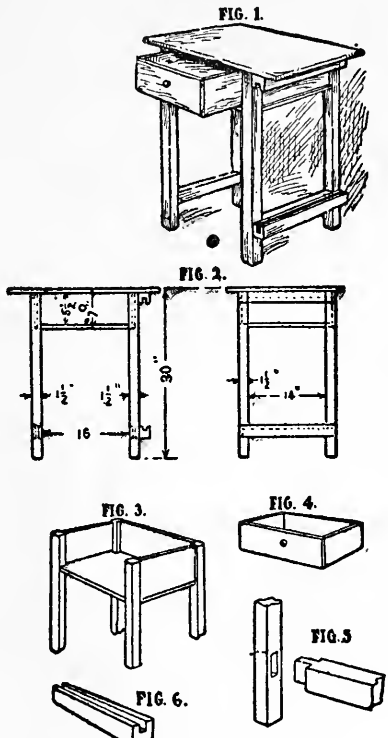
assured. In the proper development of manhood, a kit of tools is just as important as a good set of books. A boy working with his hands is developing his brain every second of the time.

A DRAWING TABLE

A drawing table is almost as important as a work-bench. Here you can prepare your plans, make your working drawings, and get all the detail of the thing you are going to build on paper.

Here is a drawing table of pleasing appearance and great utility. It is made of oak, and finished in dark or weathered stain. Let us start with the four legs. We show them $1\frac{1}{2}''$ square, but you may increase this as much as you like up to $4''$. The simple task of sawing them straight and even at the top and bottom should

be undertaken with the utmost care. Use a miter box if you have one. Remember that the experienced mechanic uses every possible aid to get his work exact. Watch a carpenter and you will notice that he has a pencil in his hand most of the time and never saws without first drawing a line with a square or bevel.



A DRAWING TABLE.

Figure 5 shows the lower rail which connects each pair of legs. The mortise or hole is chiselled out after being bored, that is, square it up with the chisel. The tongue should fit just tightly enough to require a few light taps of the hammer to send it home. This joint is glued. Brush on a thin coat of glue and let it dry,

then another, and fit the pieces together. They must be held tightly and let alone for two days. If you have no clamps, try tying with rope. The top rails are less than an inch in thickness, depending on the size of the legs. They are fitted at the same time and in the same way as the ones just dealt with. With the back rail and drawer bottom in, our work will have the appearance of Fig. 3. The table top, 14″ x 16″, is fastened by driving screws at a slant through the rails up into it, but not enough to show on top. Care must be used to avoid this. On the right-hand side of the finished article you will notice the grooved pieces shown separately in Fig. 6. These are used to hold a drawing board when not in use.

The drawing is now all that remains. There is a certain plan that must be followed in all slides, and I advise you to pull out one at home and observe the way it is made. With this first-hand information, and the dimensions furnished by Fig. 2, you will be able to manage it nicely.

To finish, rub across grain with wood filler, using felt for a rubber. If too thick, thin with a few drops of linseed oil and rub off surplus with burlap before it hardens. The filler, which comes in all shades, must be allowed one day to dry. For the next coat use varnish, thinned one-quarter with turpentine. Rub lightly with fine sandpaper, when this dries, and then apply another coat of varnish without thinning it. This will look rich and satiny if rubbed with wax.

CHAPTER III

The Boy's Room

EVERY boy has, or should have, a room of his own, and it should be his duty as well as his pleasure to keep it in order and make it pleasant and cheerful to stay in. Most boys are proud of their rooms. They fill them with trophies of the hunt, with curiosities, with pleasing pictures. Here they display their guns and fishing tackle and boxing gloves. In short, the boy's room does, and should, reflect the interests of his life.

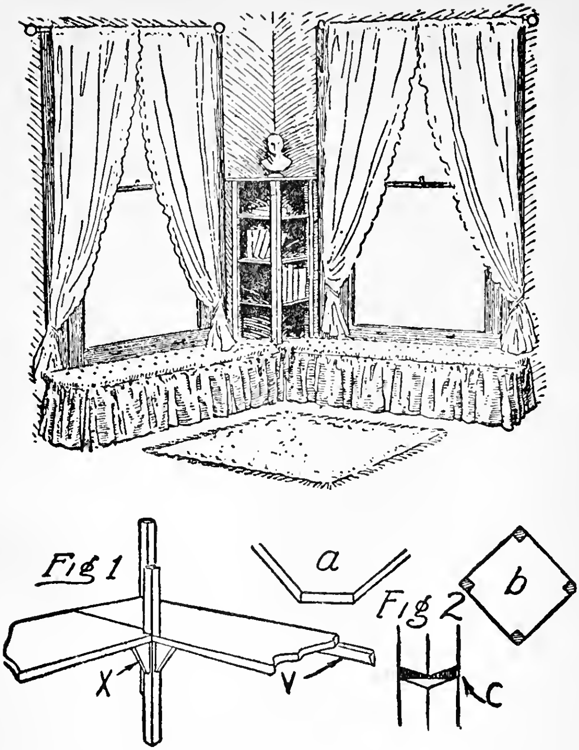
Furniture is an important item in a boy's room. You want a special sort of furniture that will fit your room, and here in this chapter we are going to tell you how to make, easily and cheaply, just the kind of things you most desire.

A READING CORNER

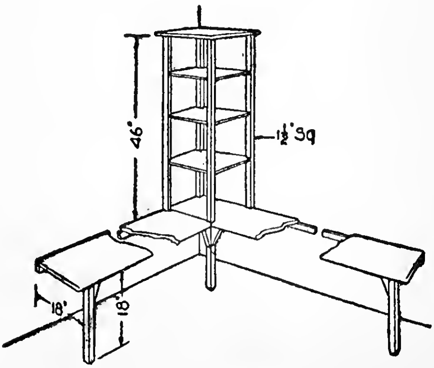
Here is a reading corner that suggests comfort, refinement, and the correct use of a neglected corner. If there is a corner in your room that has the light of one or more windows you could not do better than to utilize it in the manner shown by the accompanying picture.

All that you will need to build is the bench seat and the shelf arrangement, and if you wish the latter may be left out. The first thing to do is to screw a strip to the wall at such a height that its top surface will be 17″ from the floor. The strip itself should be 2″ x 2″ pine. The boards that form the seat should be 9″ wide. As the seat is to be 18″ wide you will need two of them to make up the width. They should be cleated together by fastening cross pieces every two feet under them with screws that are not long enough to show up on top. Put as many legs under the seat at the outer edge as you think necessary for the weight it is to bear. Space them about three feet apart.

The shelves are now made. First. make the whole thing complete and then set it on the seat, fastening in place by driving three



A READING CORNER.



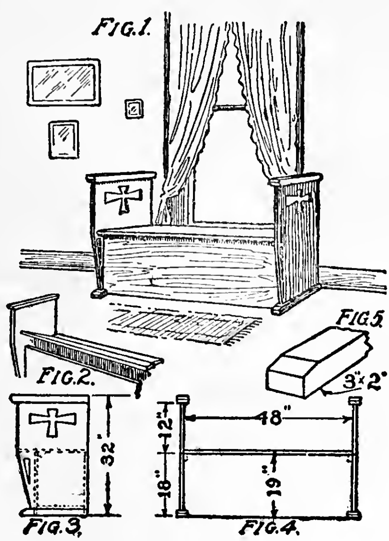
PLAN FOR READING CORNER.

long screws through the rear upright into the corner of the room. It should be stained and varnished to match the other wood work of the room. The seat may be upholstered and a curtain stretched from the top to the floor.

A WINDOW SEAT

Possibly you have only one window in your room, in which case the foregoing plan will be of little use to you. But here is one that will do nicely.

This serviceable window seat is easy to construct. A few minutes' study of the drawings will make clear all the necessary



A WINDOW SEAT.

details and then it is up to you to do careful and painstaking work. It is best to make it in the form of a portable bench, but the logical place to set it is as shown in the sketch. Each side piece is 32″ high and 18″ wide. Use the best wood you can get—oak, ash and maple being first choice. Yellow pine is ideal for an amateur on account of its easy working qualities, and it may be finished

with shellac and stain to look rich and appropriate. The rail on the top and base of each side is 2″ thick and 3″ wide. It is screwed into place and enables you to join the several pieces that form each side neatly. These pieces are also glued. This makes a close, true fit imperative. Brush on a thin coat of liquid glue and let it dry, then apply another very thin coat and quickly join them in clamps.

The seat board rests upon cleats which are screwed to the inside of each side piece. The face of the bench consists of two 9″ boards glued and cleated together. The seat may be made in the form of a lid which raises up and the inside makes a roomy storage place. The cross-shaped opening near the top of each side may be left out altogether or may be changed to suit your own taste. When complete, go over the entire outside surface and sandpaper it thoroughly. Next dust it with a brush or vacuum cleaner and in a dust-proof room apply a thin coat of shellac. When this has dried, give it a coat of mission stain, and then polish with wax. It will wear well and prove to be a neat and valuable addition to your room.

A RUSTIC LOUNGE

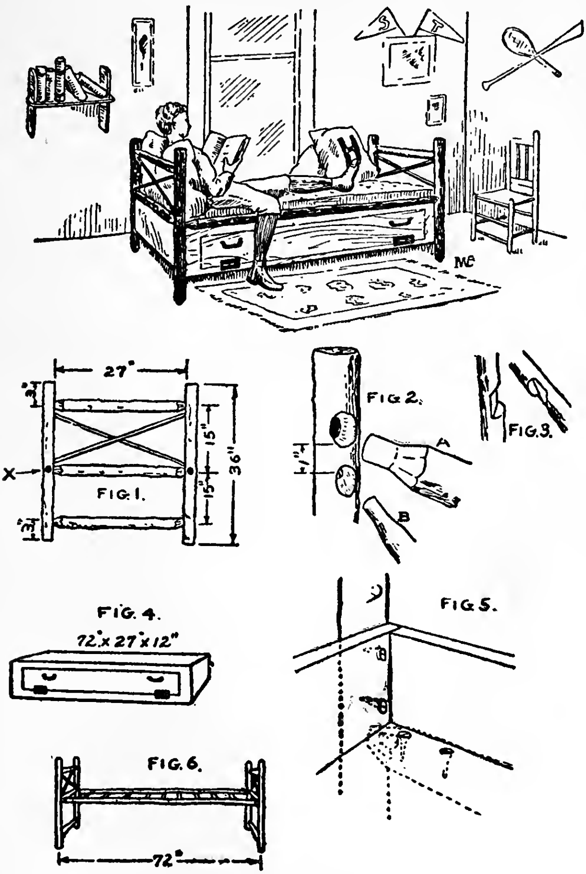
This lounge is pre-eminently a boy's piece of furniture because it is designed for a boy's room, to hold his traps, to provide him with a lounging place, to add a tinge of real boyishness to his apartment, and last but not least to give him something to do that will keep him out of mischief and teach him to use those ever busy hands in a way that will train him in the ways of manhood.

The lumber for the seat proper he can gather in the woods. Straight limbs or saplings about four inches in diameter are the kind required. In the fall when trees are being trimmed he should have no trouble in getting a sufficient quantity even if he happens to live in a place where he has no access to a real woods.

Figure 1 is a picture plan of the end of the seat and shows the number of pieces required and the size of each. Could anything be simpler? Just three cross-pieces fitting into holes bored in the two upright posts. The X-shaped braces are added for strength, and in some cases where the joints are firm may be left out of the plan. Make two ends exactly alike and then put in your long

poles. This will bring you to a stage where your bench will look like Fig. 6.

The next step is to build a box inside and under the seat. This not only makes a good storage place, but strengthens the frame



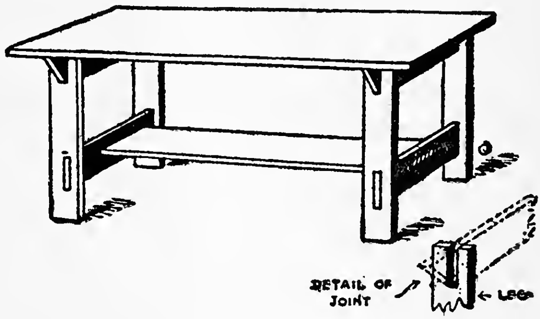
A RUSTIC LOUNGE.

wonderfully. Figure 5 shows how to screw the sides of the box to the legs of the seat. When the bottom is nailed in and the door

cut of the front panel it is quite complete. You can easily get your mother to make a cushion for the top, or you can do it yourself by getting some imitation leather and sewing it in tufts like some of your upholstered furniture. With the addition of a few pillows it makes an ideal reading seat and has that distinctly different and classy appearance that furniture makers constantly strive to attain.

A SIMPLE TABLE

Here is a table that is pretty enough for any purpose and at the same time so simple that no boy need be afraid to attempt its construction even if his kit of tools consists of only a hammer and



A SIMPLE TABLE.

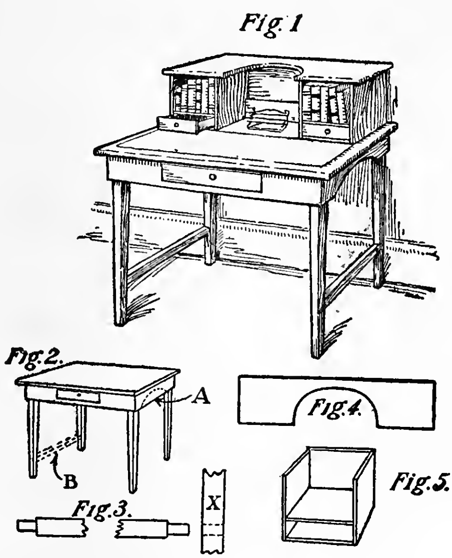
saw. The top is 5′ x 3′ and is made by gluing together three 12″ boards of the given length. You can use LePage's liquid glue for this purpose, and all you have to do is to smooth the edges that go together and brush on a thin coat of the glue. Place the glued boards in their right position on a smooth part of the barn floor and drive three spikes on each side, several inches from the edges of the outside boards. Wedges are then driven in between the spikes and the boards. Leave it thus to set and mark out your other pieces. Each of the four legs is 30″ x 6″ x 1″. The stretcher or long under-shelf is a 12″ piece 4′ long. The braces that it fits into are 24″ x 6″ 1″. The cutting and fitting of all parts is plainly shown by the drawing. When complete the table should be

smoothed with sandpaper and given two coats of white paint or enamel. It makes a beautiful piece of furniture and one that you may well be proud of.

A DESK

Of course you will want a desk. Every boy needs a place to write and study and read. Here is a first class one you can make from an old kitchen table.

First get the kitchen table, strengthen it where needed and stain it a dark oak. Old varnish may be removed by washing in



A DESK.

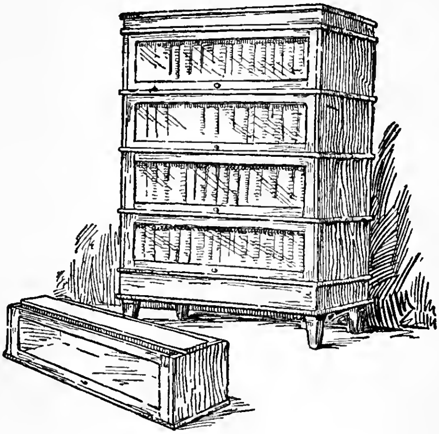
a liquid composed of three tablespoonsfuls of soda and a pint of water. Next cut the curves "A" and add the braces "B." The detail of the brace is shown in Fig. 3. On each side of the top of the desk is placed a compartment like Fig. 5. It is made of half-inch pine fastened with light nails. Figure 4 is the piece which rests over the top of these compartment boxes. It extends over the front and sides one inch. The size of those pieces depends on

the size of your table. The picture shows the right proportion, so you need not be too particular. The most appropriate finish would be a coat of mission oak, repeated after a few days and polished with wax. It will look neat and make a fine addition to your room.

A SECTIONAL BOOKCASE

Here is an excellent design for your room and you should begin to work on it without delay. The finished article is the sectional bookcase pictured in Fig. 1. There are three distinct parts to be

FIG. 1.



considered, the base, the top, and the shelf or unit. Figure 2 is a working drawing of the top. Three views are given: the end, the side, and the top. The dimensions are given and the kind of joint used is shown. It consists of four 1″ yellow pine boards, nailed together and trimmed on the edges with 1″ moulding. Figure 3 shows the unit or one shelf, which has moulding at the bottom only, to cover up the joint of "Y" "Z." Figure 3 shows the three sides of the compartment, and Fig. 6 is a picture of it, with everything in place except the door, which is a frame set with glass. The base, upon which the sections are placed, is clearly

illustrated by Fig. 4. It is simply a frame with the tapering legs set in as in Fig. 7.

FIG. 2.

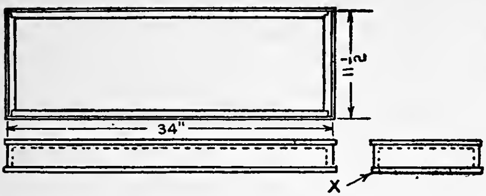


FIG. 5.

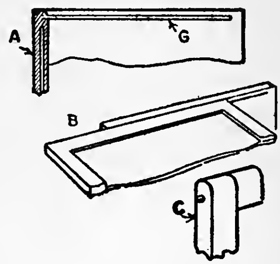


FIG. 3.

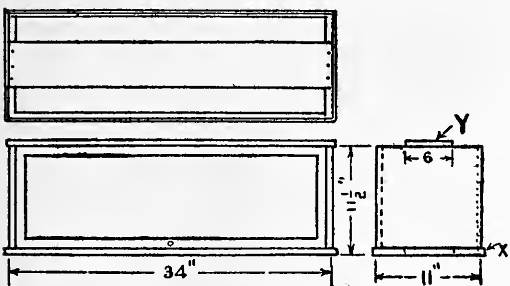


FIG. 6

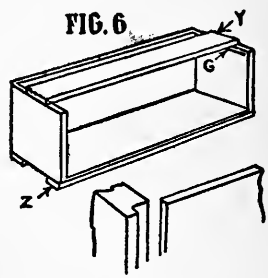


FIG. 4.

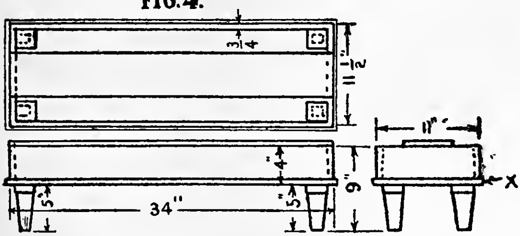


FIG. 7.

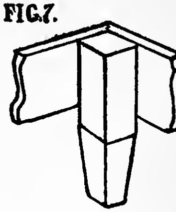


FIG. 8.

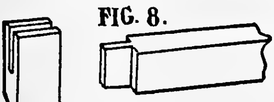


FIG. 9.

In this case the doors lift up and slide in out of sight. A detail of this plan is marked Fig. 5. "A" is the door; "B" is the door partly slid in; "G" is the top of the door rounded off. Figure 9

is a detail of the corner of the door, showing the groove for the glass to fit in. Every board is cut straight and no curves or angles are used in the bookcase, still, great care is required to produce a neat and mechanically correct job. Before sawing a board use the square to draw lines, and hold the piece up to the place it is going to occupy to make sure you have not made a mistake in measuring.

The disappearing doors work in the following manner. On the upper corners are two nails which stick out about one-quarter of an inch, as in "G," Fig. 5. These permit the door to hang from the longitudinal wire "G" in Fig. 5. To open the door, you catch it by the center on the lower rail, at which point a knob is provided, and swing it up until it is parallel with the ceiling, then push in and it slides out of sight.

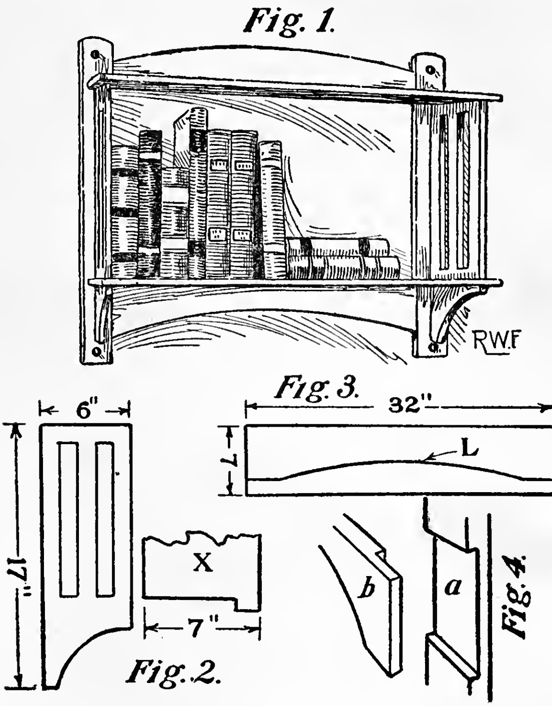
Any wood may be used to make this bookcase. Oak, chestnut, walnut or any hard wood will do best, but yellow pine is cheaper and takes a rich and elegant finish. To finish open grain hard wood you first apply paste filler, thinning it a little with linseed oil if required. Rub it across the grain with a piece of felt and wipe the surplus off before it begins to set. The filler is shaded like the stain you intend using. After it comes two coats of stain, then furniture wax or varnish. After the varnish you can produce a high luster by polishing with powdered rottenstone and polishing oil or water.

A BOOK SHELF

Possibly you have not enough books to warrant you in building a sectional case, but you are sure to have enough to fill a shelf. You will find the accompanying design handsome and useful.

The first thing to do in planning this book shelf is to get two pieces of yellow pine, oak or chestnut, 4 inches wide, $\frac{7}{8}$ of an inch thick and 22 inches long, for upright side pieces that lay flat against the wall. We now get a piece as shown in Fig. 3 and cut it on the heavy line. It is done with a circle saw. The top piece in this Fig. 3 is the lower rail in the finished drawing. It is 5 inches wide at the ends and 4 inches wide in the center at the curve. These rails are fastened to the upright side pieces as shown in the detail sketch Fig. 4. Next shape the sides with the two long slots as in Fig. 2. This is done with the small saw. Holes are first

bored to give the saw a starting point. Screws driven from the back hold the sides to the posts. The shelves are 7 inches wide and 30 inches long. The top one rests flush upon the sides and is screwed thereto. The bottom shelf is shaped at the ends as shown by "X." Its inside edge rests on the lower rail and is screwed to it. Finish hardwood by rubbing in paste filler and coating with

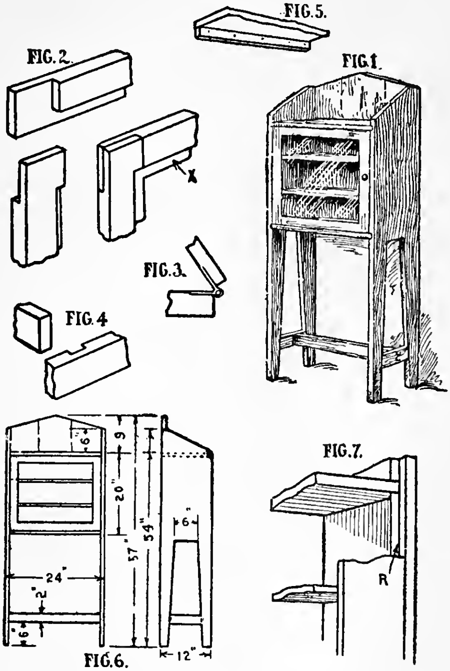


A BOOK SHELF.

mission stain. For pine fill with shellac and then stain. Either is made richer looking by polishing with wax. Do not put a glossy varnish on anything. It requires years of practice and special conditions to do it right, and if done by amateurs the fact is noticeable at a glance. For a satiny polish use wax according to the directions on the can.

A CURIO CABINET

Every boy collects something or other and the little cabinet is intended as a storage place for your collections. In Fig. 6 you get a view of all parts in their relation to each other. Presuming that you use yellow pine or white pine the boards for the sides are



A CURIO CABINET.

54″ x 12″ x 1″. The piece cut out at the bottom of each side board is 30″ long, 6″ wide at the top and 8″ at the base. Along the rear edge of these long boards is a rabbet to receive the back pieces. This is shown in Fig. 7. A rabbet is an L-shaped groove cut in the edge of the board. You can have your boards rabbeted at the mill, and should you do so a half-inch each way will be right.

When the sides are thus far cut out, nail the split section together with a crosspiece at the bottom. Figure 4 shows how those cleats are connected with a stretcher. Figure 2 is the detail of the door corner joint. "X" is the rabbet into which the glass fits. This cut shows the pieces of the door frame separately and after they are joined together. Figure 3 is an illustration of how the hinges are set in their own depth. When the door is shut, the only part of the hinge to be seen is the round part which contains the pin. The shelves are light half-inch pine pieces which rest on cleats. A view of the end of the shelf is marked Fig. 5.

The finishing of the cabinet is important. If you use yellow pine and want to finish it in natural style, simply apply three coats of varnish, the first and second being thinned and the last full strength. If you wish to stain it, put on two coats of stain after the first filler coat of varnish, and after the stain either wax it or varnish it. Open grain wood like oak requires different treatment. First you use paste filler. Thin your stain and varnish.

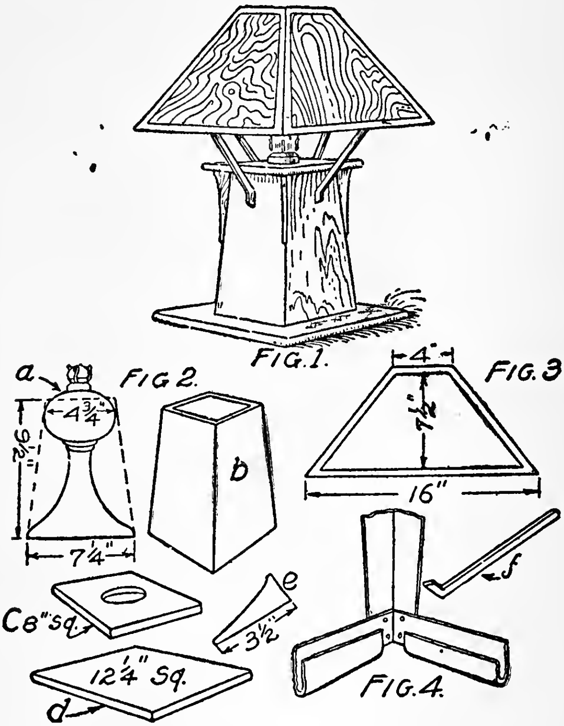
A MISSION OIL LAMP

Here is a plan that will be welcomed by those who have wanted a mission lamp, but who have been unable to indulge their wishes, because of a lack of the right illuminating medium. As you well know, either gas or electricity is usually required for this popular type of lamp, and the remoter regions of the country or the thinly settled parts of any state are without either.

Our plan in this case is well worthy of the attention of either class. It shows how to convert a common oil lamp into a mission design by building a wooden enclosure around it. There are many different kinds of oil lamps and we have taken the shape that is most frequently met with for our basis. Diagram "a" of Fig. 2 indicates the style of oil lamp we refer to. The first thing to do is to make the frame that encloses the lower part of the lamp. This applies even if yours is different from the one shown. Any kind of lumber may be used for this purpose, but, of course, the higher grade woods, such as oak, walnut, mahogany, or chestnut, are to be preferred. If you have not had much experience in woodworking it might be advisable to use clear pine, as it may be finished neatly with proper stain. It might be that you have at your disposal

a discarded bedstead or bureau that, when torn apart, will provide ample material, or if you live in a large town you may be able to pick up something of that sort in a second-hand store.

The edges of the enclosure "b" are mitered, that is, cut at an angle of 45 degrees. First, rip your pieces with a straight edge,



A MISSION OIL LAMP.

and then plane off the surplus. Mark the edges that are to come together and try them after every few strokes of the plane. This is the only safe way to get a perfect fit, and you can do it as well as the best mechanic in the world if you have patience enough. The four parts are held together with glue. The joint may be further strengthened by roundheaded brass screws, but I do not advise it.

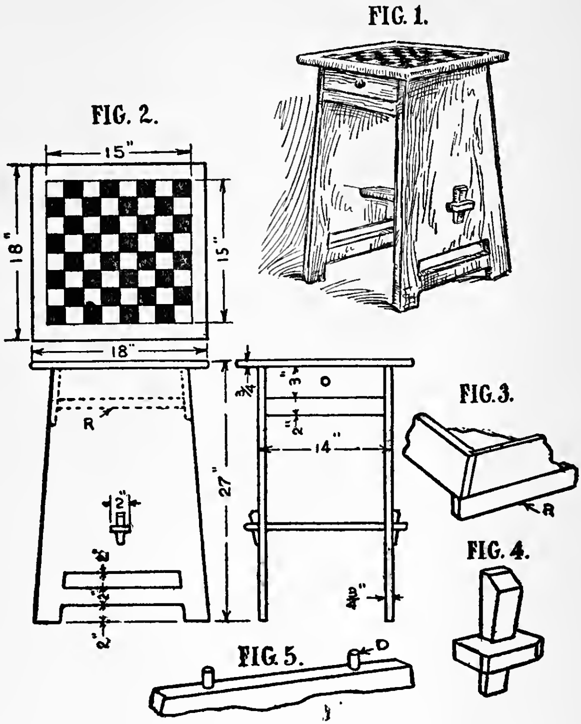
Always drill a hole for each screw you drive. The base comes next. It is simply a flat piece "d" and may be from 1" to 3" in thickness. The base is fastened to the frame by driving slender screws up from the bottom. We now cut out and finish the top piece "c." A small compass saw is useful in cutting out the circle, but it may be accomplished with a pocket knife. The top is screwed and glued in position, and we turn our attention to the corner pieces, "e." Draw out the shape on a piece of your half-inch stuff, and saw pretty close to the marked lines, then finish with plane, jackknife, and sandpaper. Glue them in place and reinforce with small screws. Liquid glue will do if you keep it covered when not in use.

We now come to the shade. The framework may be made of wood, paper or copper. The directions following apply equally to any of the three. Mark out the diagram as shown in Fig. 3. If you use sheet metal or cardboard you can repeat it four times and then bend to shape. Figure 4 shows how to bend the inside of the metal so that the glass may be fitted in. If you get strips of oxidized copper or brass you can rivet them together. The one ingredient necessary to good work is patience. Our pictures give you the right dimensions, the neatness of the finished article depends upon yourself. The glass used in the shade may be bought in beautiful colors and cut to shape, or you may get common glass and paste on it a thin filmy paper that is sold for the purpose. It is usually called glass paper, but its proper name is "vitrophane." The shade supports "f" are too simple to require much explanation. Smooth them nicely with sandpaper and fasten with screws. I might mention here that you can get a burner for any oil lamp that will permit the use of a mantle, similar to those used on gas lights. It makes a very brilliant glow and will increase the value of your mission lamp.

To finish the wood apply two thin coats of prepared mission stain according to the direction on the can, and then either one coat of shellac and one of wax, or if you like a dull finish omit the shellac and use two coats of wax. Polish with a piece of felt and you will have an article that you may be proud of.

A CHECKER TABLE

The plan herewith shows a checker table of neat and pleasing design. If you will study the top, side and end view shown by Fig. 2, you will soon have a thorough grasp of all the essentials of



A CHECKER TABLE.

the plan. All the necessary dimensions are marked, and each particular part is shown in its proper relation to all the others.

We will begin work on the sides or legs. If you are using new material, we would advise you to get yellow pine. It works easily and takes a fine finish. To shape the legs you will need a brace and various sized bits, a small circle saw, a good, sharp

knife and some sandpaper. First you must glue together two 9″ boards to get the required width of 18″. Use liquid glue in the following manner: First put on a thin coat and permit it to dry and fill up the pores of the wood; next put on another thin coat with a brush and immediately clamp the pieces together. The clamping may be done by placing the glued pieces between blocks nailed to the floor and then driving in wedges to tighten them together. You must also put something heavy on the joint so that it will not spring up. On the top of each side-piece are two wooden pegs, "D" in Fig. 5. These fit into corresponding holes in the top piece. The center brace, which extends through the legs, is toe-nailed from the inside. The wedge-shaped fastening shown in Fig. 4 is more for effect. The drawer rest near the top fits between the legs and is simply nailed into place. The detail of the drawer is pictured in Fig. 3. The piece "R" is one of the rests upon which the drawer slides. The ruling of the checker board must be accurately done in order to look right. First, make the large square, then the line from top to bottom in the center, then a line which crosses that in the center and so on. The drawer pull is a small brass knob, which may be bought for a nickel.

Finishing consists of two coats of mission stain, one day apart, and then a thorough polishing with wax, which is sold for this purpose. Altogether it makes a fine addition to a home, especially to the boy's room.

CHAPTER IV

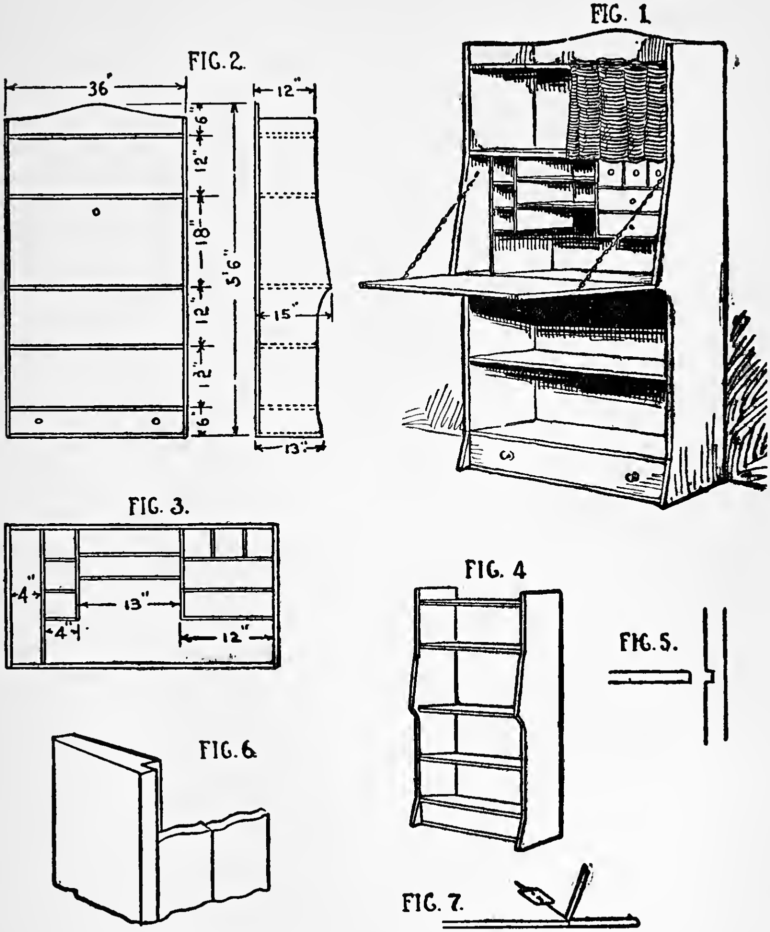
Mission Furniture

COMBINATION BOOKCASE AND DESK

The accompanying illustration shows a combination article that you will have abundant use for. It makes a roomy bookcase for reference works and can be instantly converted into a desk for your study work. It is designed in such a simple manner that the boy with only a few tools and little experience can confidently undertake to construct it. If you study the sketches you will note that every piece is shown in its proper place and every joint used is clearly pictured. Begin with Fig. 2 and you will learn the dimensions. The first thing to do is to cut out the long side pieces. The rear edge is rabbeted to receive the back pieces. Observe Fig. 6 to get this idea. You can order this done at the mill with no extra expense. If you cannot get boards 15″ wide as required, you will have to glue an 8″ and 7″ piece together to form each side. The variation in the width, as shown in Fig. 2, should be carefully marked out and sawed. Do not saw exactly on your line, as allowance must be made for the finishing to be done with plane and sandpaper. When this is done mark cross-lines for the shelves. You can sink the shelves into grooves, or put wooden cleats for them to rest on, or small angle irons. For amateur work I prefer the latter. The angles may be purchased at slight cost or made out of strap iron as thick as a book cover.

When the shelves are in place, our job will look like Fig. 4. Next comes the back, which will materially strengthen the structure. The compartment box, as in Fig. 3, is entirely made before being put in place. Use quarter-inch pine for the shelves and half-inch stuff for the outer shell. All the edges are glued and 1″ brads are used to hold parts together while the glue sets. It requires a good deal of figuring to assemble the box as shown. After the outer shell is made the entire inner structure is nailed together before being slipped into it.

The drop leaf, which also serves as a writing rest, comes last. It is carefully fitted and hinged as shown in Fig. 7. Other fittings



COMBINATION BOOKCASE AND DESK.

are a knob and lock and the chains. For a natural wood finish on yellow pine apply three coats of varnish, the first and second

being thinned with turpentine. After the first thin coat you may stain any shade desired, applying two coats. Yellow pine finishes very nicely and will last practically as long as any hardwood.

A SEAT

Here is a settle that will be found serviceable in the hallway or in a boy's room. It is simple and pleasing and can be made of

FIG. 1.

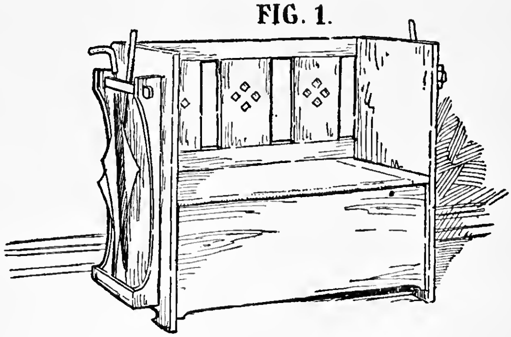
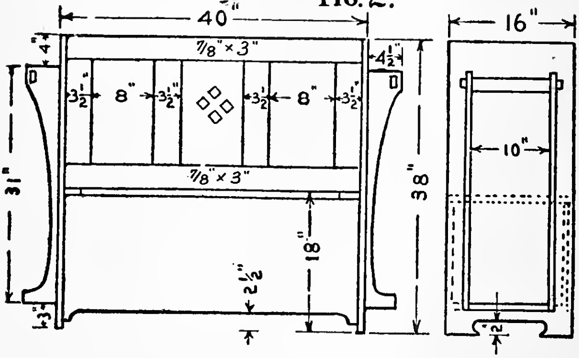


FIG. 2.



A SEAT.

pine boards, or out of the material in some old-fashioned wooden bedstead. The sides extend in one piece from the floor to the top of the highest back rail. Each one is 16″ wide and 38″ long. It will probably be necessary to glue two 8″ boards together to

get the required width. For a clamp use heavy blocks nailed to the floor, which must be perfectly level. Place your boards between the blocks and wedge them in tightly, besides weighting them down. Both pairs may be handled at once.

When the sides have set, make and fasten in place the umbrella rack on one or both ends. All parts of this are shown on the drawing, with the exception of the small bottom board upon which the umbrellas rest. After the sides are thus complete, nail in the lower rail of the back rest, then the upright pieces which are mortised into it, then the top rail. The face board under the seat comes next. Lastly, set in the seat. This may be permanently nailed front and back or it may be put in like a door hinged at the rear, the hollow part of the body, in this case, serving as a storage place for rubbers, boots, and other bad weather necessities. Glue is used at every joint, and in addition nails or screws are driven from the concealed side in such a way that they will not show on the surface.

If you use yellow pine and wish to finish in the natural grain, the proper application will be three coats of varnish, the first being thinned one-quarter with turpentine, the second one-eighth and the last used just as it comes from the can. A very light rubbing with sandpaper may be given between the second and third coats. A hardwood finish consists of applying filler, stain, varnish or wax, and then, if desired, polishing. Follow the order given. You can get small quantities of wood finish, with full directions on the cans, in hardware stores or department stores.

A WRITING TABLE

This design for a writing table has the following qualities which should recommend it to your attention. It is neat, easy to make and inexpensive.

The legs are the first to be made. Use three-quarter oak or any hard wood, or pine if you must. The measurements and shape are shown in Fig. 5. Carefully mark them out on the lumber with a pencil before cutting with saw or plane. Finish one until you have it as perfect as your skill will permit, then use it as a pattern for the others. When the legs are done the hardest part of the work is over.

You next connect each pair of legs by two strips, one inside the top of the legs and the other for the drawer to rest on. Figure 3 shows the table when the first stage of the making is complete. Only simple shaped strips are used (leaving out the legs), and you should have no trouble in getting the legs together in the exact manner shown by the picture.

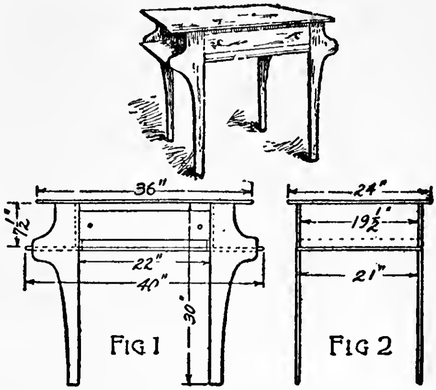


FIG 1 FIG 2

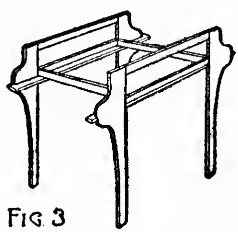


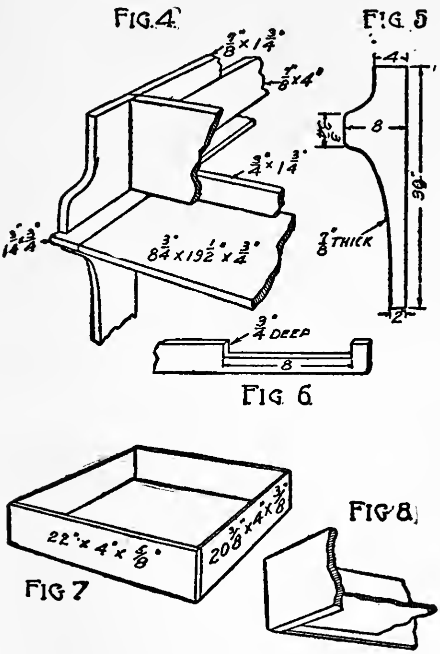
FIG. 3

A WRITING TABLE.

When you have this part accomplished, put on your table top. Care must be taken to get the prettiest side of the boards up and to join them in a way that will show the grain off to its best advantage. A little shelf is placed on each end of the table for books to rest on.

The kind of joint you are to use so that no nails or screws will be seen is quite a feature of the work. Wherever two pieces of wood come together use a thin coating of glue. Liquid glue is

good enough. First put a thin coat on to fill up the pores of the wood, and after it has dried brush on another coat for adhesive purposes. The nails and screws used are always driven from the reverse or unseen side, and do not pierce the piece they enter clear through, but only part way. Use long slender screws and always



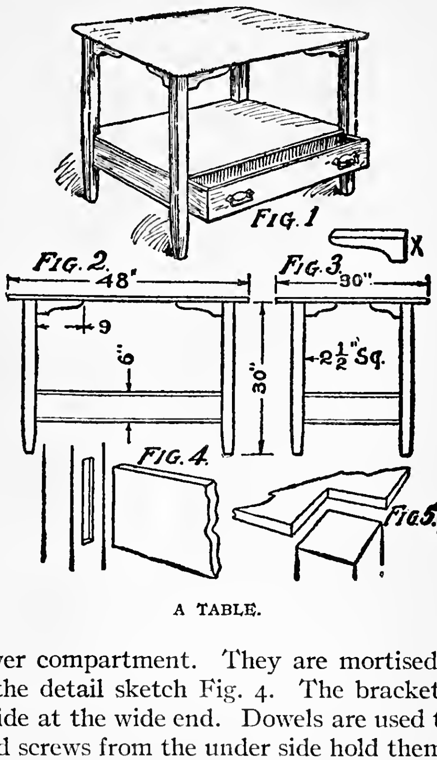
A WRITING TABLE.

bore a hole for each one. It takes time and patience to do it, but the best is none too good for you. Examine the stands and tables in your own home and note how the parts are held together.

A TABLE

Here is a useful hint on increasing the value of a table. The idea is to add a slide to the under side of the shelf. This large drawer, which is practically out of sight, makes a roomy place to store books

and other material. The table itself is of simple construction and is amply described by the side and end views Figs. 2 and 3. As to material, the costlier woods are always to be preferred, but pine will answer as well. The 4″ x 4″ legs taper slightly at the lower end. The first part of the work will be to glue and cleat the pieces which form the top together. The shelf pieces are glued, but not cleated. They are fitted at the corners as shown by Fig. 5. The rails are $2\frac{1}{2}''$ wide pieces which form the sides and back of



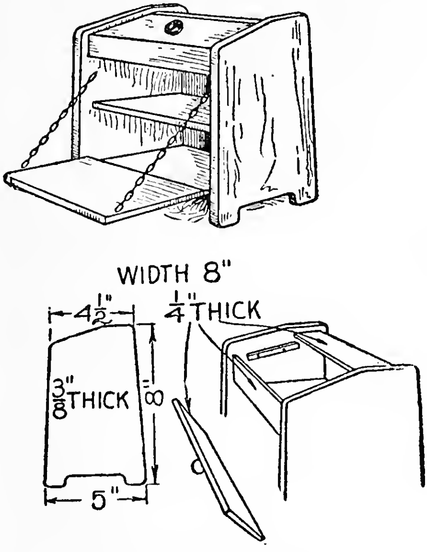
A TABLE.

the slide drawer compartment. They are mortised into the legs, as shown by the detail sketch Fig. 4. The brackets used are 9″ long and 3″ wide at the wide end. Dowels are used to fasten them to the legs, and screws from the under side hold them firmly to the table top. The sides and face of the slide are of 1″ stuff, the bottom is of half inch. As a finish put on a thin coat of shellac and then stain to suit taste. Wax rubbed on according to the direction on the can makes a neater and classier finish than varnish. It

requires no skill to put it on, while varnish must be thoroughly rubbed and made even or it presents an ugly appearance.

A HANDKERCHIEF BOX.

A handkerchief or trinket box is a handy thing to have and always makes a welcome present. If you follow these directions you can make one easily and with small expense. The sides of the box are the only parts that will tax your skill and patience.



A HANDKERCHIEF BOX.

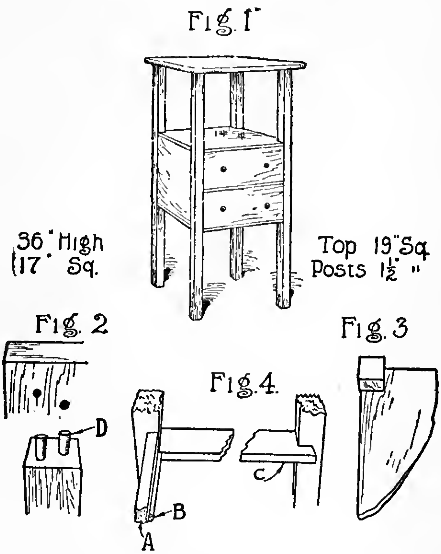
Lay your flat piece of oak on a table and carefully mark the diagram to the shape and dimensions indicated by our sketch. When you have sawed them out, cut three grooves on the inside of each to receive the ends of the shelves. The grooves need not be any deeper than the thickness of a match and may be gouged out with a sharp knife. The three shelves are now glued in and left to set over night. The back of the cabinet is nailed to the shelves and sides and serves to strengthen the whole frame. The top compart-

ment and front door are clearly shown by the drawing. The cover lifts out, and when in place rests upon the small cleat as shown.

The finishing of the cabinet is a very important part of the work. First smooth it with the finest sandpaper, then apply wood filler of the desired shade, next brush on some mission stain, and when it has dried a few minutes rub off the surplus with a soft rag. The next day stain it again and finally polish with furniture wax. You can get small half-pint cans of this finishing stuff at any good hardware or general store.

A CABINET STAND

Here is a neat and useful cabinet for books, or papers, or for curios or a collection of something not too bulky. It is made in



A CABINET STAND.

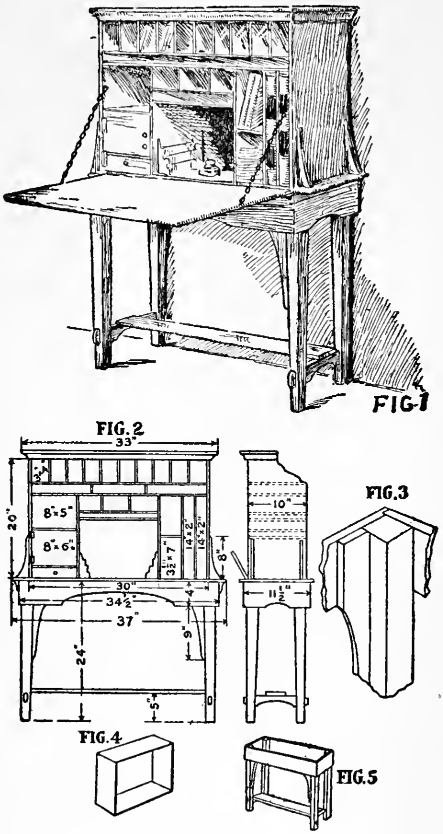
plain mission style and will be just the thing for a beginner to try his hand at.

Your first work should be on the posts. All that you need do is to square the ends. This is not quite as easy to do as it sounds, but with great care you will be able to accomplish it. We next put in the pieces that fit on the right and left sides of the drawers. They are 1″ thick and 12″ wide, and fit between the legs. Their length will be about 13″. They are held in place by what is called the dowel joint. The dowel consists of wooden pegs fitted into holes bored into the two edges that come together. They are just like the pegs in a common table leaf, only they are glued tightly. After you have the sides in place let them set for a day, and in the meantime you can work on the table top and the top of the drawer section. When these are in place, you can measure and fit the drawers. The table top is fastened with dowel pins as shown in Fig. 2. In Fig. 4 "B" and "C" are small strips upon which the drawers will slide. Figure 3 shows one corner of the flat piece that fits on top of the drawers. The face of the drawers should be of 1″ material, the rest of them may be made of half-inch pine. For a neat finish brush on two coats of prepared stain a day apart and then either varnish or rub with wax. If you are careful in your work you will be more than pleased with the finished stand. It will prove ornamental and useful and will help you to keep your room neat.

A DESK

The desk shown herewith is designed for home use and will stand a good deal of hard knocks. If care is taken to get the lines straight and plumb it will present a neat and pleasing appearance. Above all its good points is its simplicity and the fact that any smart lad with a hammer and saw at his disposal can build it. Figure 2 shows a front and side view of the completed desk, every piece and its dimensions being graphically described. First dress down four pieces for the legs, 24 x 2 x 2-inch oak. They are tapered toward the bottom as shown, or may be left straight. At a point 4 inches from the lower ends join each pair with a brace which goes through a square hole previously chiseled out. On top of those braces and 5 inches off the ground is the long shelf connecting the leg pairs. We now build the frame shown in Fig. 4 and place it in its position as in Fig. 5. Curves may be cut on the under side of this frame or they may be left straight if you prefer the rigid

mission style. All the corner joints used so far are clearly shown by Fig. 3. We now put a flat board covering on top of the framework shown in Fig. 5, just as if we were making a table instead of a desk.



A DESK.

We now build the upper section of the desk, beginning by setting in place the two side uprights, 10″ x 20″ oak. Wedge-shaped fancy braces similar to the ones for the upper parts of the legs help to hold the sides firmly to the table top. The top of the desk,

33″ x 12″ oak, is now prepared. The edges must be routed as shown. An amateur must do the biggest part of the work with sandpaper and must exercise great pains to produce an even and graceful curve. A wood chisel with a curved bit is the tool to use if you can. The compartments in the upper section are shown and need no further comment. You will have to use ingenuity to get them built firmly and neatly.

The front door, which drops down to serve as a writing surface, is our next work. It must be made of several pieces glued together. It must fit accurately in the frame of the upper part, but should not bind or scrape, as it will have a tendency to expand a little, like all doors. Use neat brass hinges and a strong brass chain to suspend it. When you have all the building work complete, go over the entire surface with fine sandpaper and rub off all roughness and discolorations. Then brush off all dust and apply stain according to directions on can. Use it very thin and put on three coats if necessary. A wax rubbing will finish it nicely, but if you prefer use varnish. It requires a good deal more skill to properly apply varnish. This desk may be made of all pine and finished the same way. It is ideal for a boy's homework and makes study inviting.

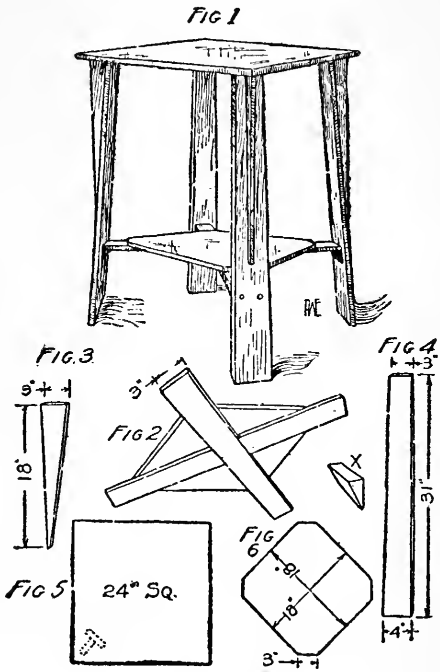
A STAND

A stand of neat and pleasing design that offers the amateur mechanic some chance to profitably exercise his talent can be readily made by the boy who is handy with tools. Its usefulness will not be questioned, for no home has quite enough small tables. There is one more essential feature embodied by this design, namely, simplicity. Only flat, one-inch boards of the commonest type are used, and all the lines are straight lines.

For the top you use two pieces twelve inches long and the same in width. If you use yellow pine or some wood with a nice grain, select the prettiest pieces for the table top. The two parts are glued together and cleated with light strips about the size of laths. Be sure to use screws that are not long enough to show up through the top. The method of gluing is simple. When you have the edges that come together nicely fitted, brush on a light, thin coat of liquid glue and let it dry. This is to fill up the pores of the wood,

and another coat must be put on just before you bring the edges together. Allow a day for it to set.

The legs are three inches wide at the top and four inches wide at the base. Pile them on top of each other and make sure that they are all the same size. The shelf or under part of the stand is shown in Figs. 2 and 6. The shelf proper rests upon two diagonal



A STAND.

braces. Where those braces cross each other in the center you must cut a mortis as wide as the width of the brace and as deep as half its thickness.

In assembling, first screw the legs to the shelf, using the wedges "X" for them to rest upon. Now cut the bottom edge of the legs to such an angle that they will stand perfectly on a level floor.

Now lay on your top and keep at it until it rests even. Next screw to the outer side of each leg one of the wedge-shaped pieces shown in Fig. 3. When they are in place, try the top again and mark the outlines of the legs with a pencil. The outline of same is shown in the lower left corner of Fig. 5. Upon those outlines paint the glue. The table top is fastened also with small screws driven from the inner side of the leg up in a slant direction into the top.

A beautiful finish on any kind of wood may be obtained in the following manner: First a coat of water stain of the desired color, mission oak or dark oak being preferred for this table. Next a coat of filler, followed by another coat of the stain, and lastly a thin coat of wax. When the wax has dried it may be rubbed to a satiny shine with a piece of cloth that is free from lint.

BLACKING CASE

A neat and serviceable article which every boy can make and use to good advantage is a blacking case to hold the brushes and other stuff and also furnishes a support for the shoe while polishing. Figure 3 shows end view and a side view with the necessary dimensions. The material used is 1″ pine. First lay out the boards which are to form the legs. These two pieces are each 12″ x 18″. To make the curve at the bottom, first bore a 1″ hole in the center of width and 7″ from the bottom. Now mark a point 2″ in from each of the low outside corners. From these points you can inscribe a regular curve to the hole you have bored. Take plenty of time and have both alike before you begin to saw. You may now cut and nail in the back piece which is 7½″ x 11″, and fits between the legs just described. At the front nail in two 1″ cross braces, between which the drawer fits. All of the drawer except the face or outside piece is made of half-inch stuff. The face is of 1″ stuff. The top consists of two pieces of 1″ pine 7″ x 14″. One is nailed on solidly, the other is hinged to it. Use small square hinges and put them on as shown in Fig. 2. They are sunk into the wood the depth of their own thickness. The hinges will cost five cents and a knob for the center of the slide may be obtained for the same price. The block or shoe rest which is screwed to the top is shaped by tracing around a shoe and then cutting with a small circle saw.

Make it of two inch stuff and screw it through a small hole bored with an eighth-inch bit.

FIG. 1.

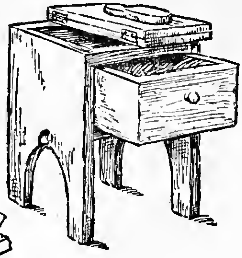
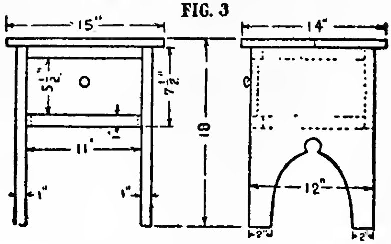


FIG. 2.

FIG. 3



A BLACKING CASE.

The finish may be two coats of dark mission stain or two coats of black paint. If made carefully the cabinet will present a neat appearance as well as give good service.

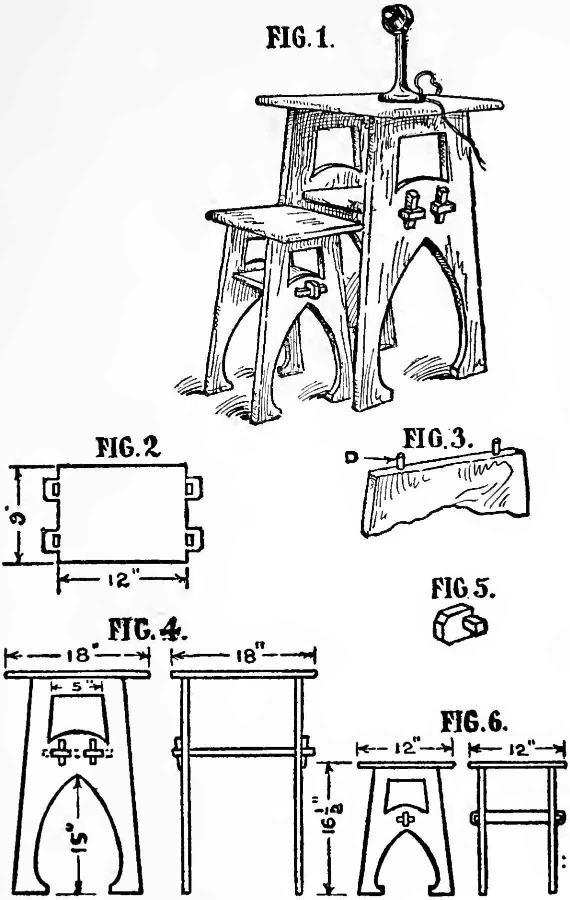
STOCK LIST

Legs, 2 pieces	12" x 18" x 1"
Top, 2 pieces	7" x 14" x 1"
Back, 1 piece	7½" x 11" x 1"
Drawer, 3 pieces	7" x 11" x ½"
Drawer, 1 piece	11" x 11" x ½"
Drawer, 1 piece	7" x 11" x 1"

Hinges, nails, knob, paint.

A TELEPHONE SET

A stand and a chair whose purpose is to make the use of the telephone more convenient are easy to make and will be appre-



A TELEPHONE SET.

ciated by father and mother. As they are the same in all respects except size, it will only be necessary to describe one.

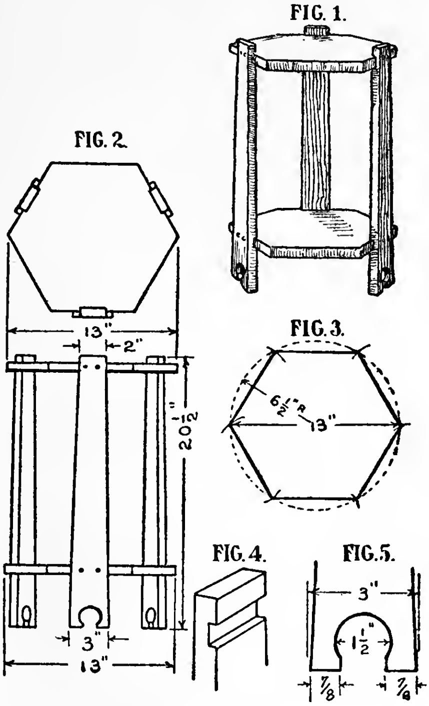
About the only cutting there is to be done is that required to reduce common boards to the shape of the leg pieces. In order to get the required width, 18″, you will have to temporarily cleat together two 9″ boards. Mark the design as shown in the cut with pencil. It is very likely that it will take you longer to do this than you at first supposed it would, but the all-important thing is to get it done right. Don't be satisfied with almost right. Make it accurate and well balanced in every detail, for upon the correctness of your diagram depends the beauty of the finished piece. When the marking is done, remove the cleats and saw out the proper portions. Next make a shelf like Fig. 2. Connect the legs with it and drive small finishing nails in such a way that they will not show. On the top edges of the legs you must bore holes and glue in two pegs, as illustrated by "D" in Fig. 3. These fit into corresponding holes on the under side of the table top.

The finishing process is important. First remove all roughness and soiled appearances with fine sandpaper, then brush on a thin coat of mission oak stain. Before this dries wipe off the surplus with a clean lint-free rag. Next day put on another coat, and so on until the wood is an even color. A coat of the very best varnish might then be applied, to be polished two days later with wax. If finished like this, the set will be as beautiful as it is serviceable.

PLANT STAND

Here is a plant stand of simple design which will be very nice for the porch this summer. There are two units, that is, only two pieces of different shape. One of these is the shelf piece, of which there are two, the other the leg, of which there are three. The material used is quartered oak or yellow pine, one inch thick in the rough and a little less when dressed down. Order it from the mill planed and sandpapered on all sides. Two boards 7 inches wide and 28 inches long are glued together, and two circles 13 inches in diameter are inscribed on the same. Figure 3 illustrates this. Each of the eight sides of the octagonal disk will be $6\frac{1}{2}$ inches long. In this part of the work, which is the simplest, great care is necessary. Mark out the whole thing before you touch it with a saw. Use a fine-tooth saw, work slowly, and sandpaper the edges to a fine degree of smoothness. Wrap the sandpaper around

a flat block and rub it slowly, using long, firm strokes. The legs are 3 inches wide at the base and 2 inches wide at the top. The circular piece cut out of the bottom is 1½ inches in diameter. It is first marked and then either bored out with an extension bit, or sawed with a scroll saw. More patience than skill is needed to



PLANT STAND.

insure a good job. The groove at the top as shown in Fig. 4 is first marked out, and then sawed to a depth of one-quarter inch, the loosened piece being taken out with a wood chisel.

The parts are fastened together with round-headed blue screws. Bore a hole for each screw as big as the shank, or that part of the screw that would still be left if the thread was stripped

and filed. This is a good point to remember for it applies to all wood work.

If you use yellow pine, finish by giving a first coat of varnish thinned one-half, a second coat thinned one-eighth, and a last coat just as it comes from the can. For oak, first fill the pores of the wood with filler in paste form of the shade you like, then varnish and polish with wax, rottenstone, or rubbing oil. You will like the appearance if you use pains.

CHAPTER V

Novelties for Christmas Presents

A BOOK SHELF

In selecting material for jobs of this kind it is really economical to choose white oak, walnut, or chestnut. They are not the cheapest, but only a small amount is required and you will want your shelf to be rich and well finished. You can have the pieces cut pretty close to the size of the finished parts at the mill. For the base get a board slightly larger than the size marked, allowing $\frac{1}{8}''$ on all four sides for planing and sanding. Next we tackle the upright ends. They are 9″ high and the corners at the top are rounded. If you have a small saw you will be able to round them off without much trouble, but you can do it with a knife and sandpaper just as well, only it takes more time. When you have the ends done it is time to lay out the groove into which they fit. Figure 3 illustrates a properly cut groove. Stand the end on the base and mark along its edges with the point of your knife, making sure that your lines are straight and parallel. Then clamp down your baseboard and saw to a depth of $\frac{1}{4}''$. The thing to avoid is getting your saw cut too deep. A narrow wood chisel will be very useful in gouging out the wood between the saw cuts. It is best to build the end pockets and attach them to the ends before securing the base and ends together. The pocket is made of two side pieces and one end. Figure 2 is a picture of the side piece. You can do the curve cutting with a circle saw, finishing with a round stick wrapped in sandpaper. The end is clearly shown in Fig. 4. The parts should now be fastened together with glue and small screws, preferably the blue, round-headed variety. Brush on a thin coat of liquid glue on all parts that are to touch and let it dry, then when ready to join another thin coat will suffice. In a glue joint the parts should touch each other evenly at every point. For that reason the use of screws as a reinforce-

ment is advised. If the amateur can make a perfect fitting joint he may omit the screws. Have a gimlet at hand and bore small holes for the screws. In woodworking it is desirable to drive nails and screws in such a way that they will not be visible in the finished article. Look over any piece of furniture and you will see how this idea is carried out. The top shelf must be fastened with screws driven from the outside ends. In this case, where it is impossible to hide the screw, get one that will look good.

FIG 1

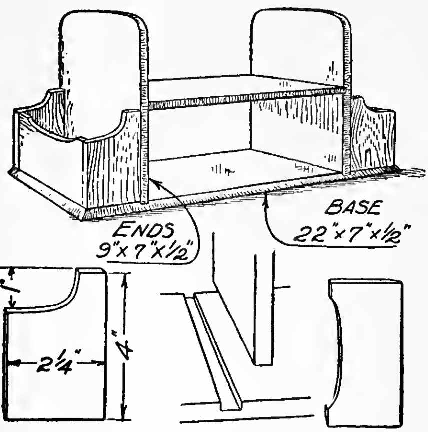


FIG. 2 FIG. 3 FIG 4

A BOOK SHELF.

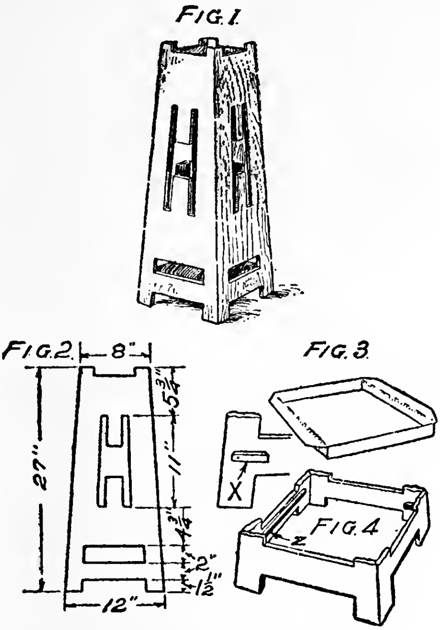
The finishing of our bookshelf must be carefully done. Put on several thin coats of mission stain with a small brush that will enter all corners. A day between coats must be allowed for drying. You can get a stain that will require no additional finish, but it will be improved by rubbing with wax. The wax is inexpensive and gives a satiny shine that looks very much like the real store furniture.

AN UMBRELLA HOLDER

The umbrella receptacle shown in the accompanying sketch is of neat and simple design and can be made of common pine

boards by any boy who cares to try his hand at it. It will be found useful in any home, for rain sticks certainly have a habit of hiding or disappearing altogether.

To begin with, get a board 28″ long and 12″ wide. You must then carefully mark out a diagram like the one indicated in Fig. 2, using the dimensions given there. The slot-shaped holes are cut by first boring through with a 1″ bit and then sawing with a



AN UMBRELLA HOLDER.

compass saw. The round hole made by the bit can be squared up with the saw and finished with a flat file or sandpaper. The four sides are alike and may be joined in either of these two ways. The first and neatest joint is shown in Fig. 4 and consists of planing or sawing the edges that join to an angle of 45 degrees. The other way, and by far the easiest for amateurs, is to simply leave your boards square at the edge and nail them flush to each other. In

either case use round-headed blue screws to hold the parts together, and try the edges often enough to make them fit nicely before driving the screws. In assembling the sides, first tack them together with small finishing nails and then bore holes for your screws. When the screws are in, draw the nails and putty the holes.

At the bottom of the rack on the inside place a tray made of sheet metal. Its shape and the manner of putting it in place is clearly shown in Figs. 3 and 4.

The simplest finish consists of careful sanding, then two coats of prepared mission stain. Each coat should be allowed a day to dry. Brush it on thin and as quickly as you can, then if there is any surplus wipe it off with a clean rag. After the stain has dried apply either wax or varnish. If you work carefully and follow directions you will be greatly pleased with the finished article.

WASTE BASKET

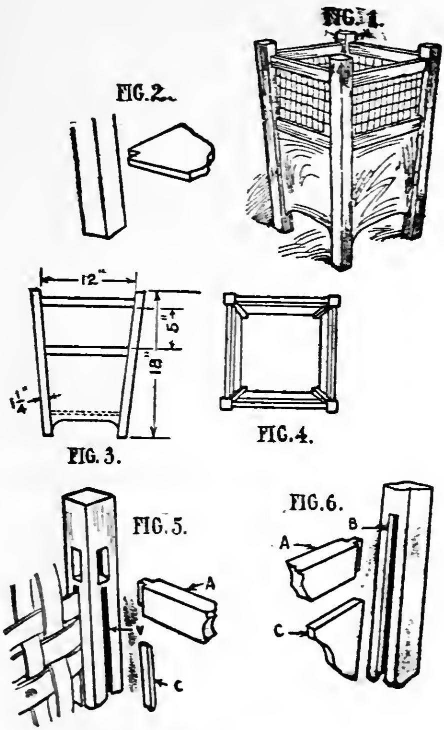
A waste basket in use in the home must be neat and rich looking, and should harmonize with the rest of the furniture. In the plan given herewith an attempt is made to fulfil these requirements. The scrap receptacle is mission style, but slight touches here and there would make it fit in with any type of interior decoration.

The posts are one and one-quarter inches square and 18 inches long. On two sides of each post are scored grooves wide enough to receive the tongued ends of the sides, as in Fig. 6, and one-quarter inch deep. Before cutting the grooves, shape and finish all the pieces which form the sides of the basket. These, as well as all other parts, should be of yellow pine. The thin board which forms the bottom half of the sides is one-eighth inch thick; the heavier cross-pieces are 2 inches by ½ inch and of the dimensions shown in Fig. 3. The only way you can make those narrow grooves is with a knife or small wood chisel. A drill and small size bits will prove useful in getting started. Mark lines carefully before you begin cutting. Brush liquid glue on all tongues or tenons and also on the inside of the grooves. A light even coat is preferred to a sticky mass. Small nails driven from the inside through both post and tenon will strengthen the basket.

The weaving of leather straps, or an imitation of the same, is simple. Tack the upright strips into place with upholsterer's

tacks and weave in the horizontal ones as in Fig. 3. You may use imitation leather or heavy paper or felt or brown cloth.

The finishing is done in the usual way. Sandpaper and, if necessary, wash off all dark spots and discolorations. When the

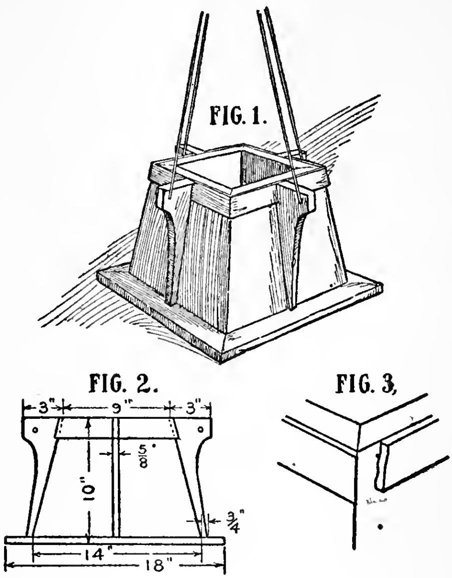


A WASTE BASKET.

surface is smooth and dry, brush on a thin coat of prepared mission stain, quickly wiping off the surplus with a soft rag that will not shed lint. Next day apply another coat of the mission oak stain, and after that polish with prepared wax. This gives a thin satiny gloss which is preferred to the high shine of varnish.

HANGING FLOWER BOX

Here is a design that will add beauty and refinement to the appearance of your front porch. The lines of the box are simple, but it must be carefully made to avoid a cumbersome look. A piece of 1″ pine board which is 10″ wide and 66″ long will provide the four sides. Each side is 9″ wide at the top and 14 inches wide at the base. The edges which join each other to form the box



HANGING FLOWER BOX.

are beveled, that is, planed off to an angle of 45 degrees, as shown in Fig. 3. Fasten them with finishing nails, driving the heads beneath the surface of the wood, so that they may be covered with putty and paint. The flat base board is 18″ square. It is made of four triangles, each of which measures: base, 18″; altitude, 9″. By using this four-piece plan you are enabled to get the base from your 10″ board. Nail the base to the sides, taking care that they rest even. Around the top nail a light strip of moulding. Some-

thing 2″ wide and very plain will be appropriate, but anything you have on hand may be made to serve the purpose.

The four pieces to which the wires are attached must be sandpapered on the sawed and curved edges until they are very smooth. They are fastened by driving nails or screws from the inside of the box outward against them. The interior of the box may then be lined with zinc and a few holes bored in the bottom to let out the surplus water. The lining may be omitted, but its use will make the box last longer. When the parts are all assembled, sandpaper the entire surface and apply a coat of green paint. When it has dried, putty over the nails and apply one or two coats of the green paint and a coat of varnish. You will then have a weather-resisting box that may be kept clean and glistening all the time.

COMBINATION CLOCK AND SHELF

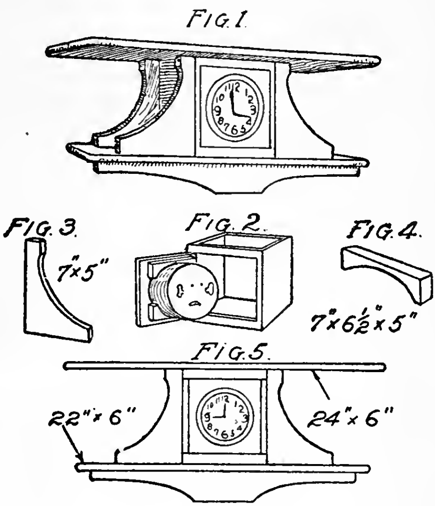
The neat and practical article pictured here will afford a fine opportunity for the boy with mechanical talent to exercise some of it. If you study the several parts that go to form it you will note that they are of simple shape and quite easy to cut out.

The first piece to give your attention to is the base. It is 22″ x 6″ and ½″ thick. Its shape is that of a simple rectangle with the corners rounded a little. Mark the curve at the four corners with the same object, say a coin or paper pattern, and do the rounding off with a knife and sandpaper. The next part we tackle will be the flat top piece, which is 24″ x 6″. Save for its extra 2″ in length it is similar to the base board.

We will now take up the part that encloses the clock. An alarm clock of ordinary size is the kind we use. We first need a piece 7″ x 5″ x ½″ thick. Find the center and from it draw a circle which tallies nicely with the clock face. Cut the circular piece out with a compass saw and fit the clock into it. It will take quite a little patient effort to do this right, but you will be well repaid for the pains you put into it, as it is the showiest part of the finished article. Now to hold the clock securely in place we brace it on the top and bottom with pieces shaped like Fig. 4. Figure 2 shows clearly how those pieces look when in place. It is now time to build the boxlike center part shown in Fig. 2. It may be made of half-inch pine with the exception of the face piece or front.

This consists of a small frame that encloses the square piece into which the clock fits.

When you have completed it, lay on the top and fasten it with small screws, remembering to always bore a small gimlet hole before inserting the screw. The hole should be just the size of the shank of the screw. The shank is that part which the thread encircles. The thread is the only part intended to bite into the wood. If you have to force hard, the screw will act as a wedge and split your work. Next comes the base board. Note the piece



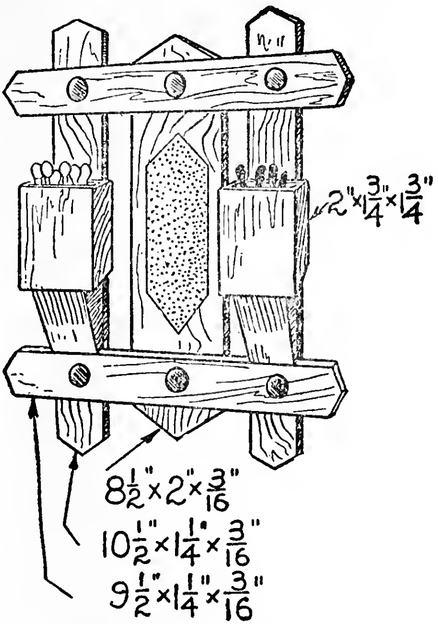
CLOCK AND SHELF.

that runs along under it. It is about 23″ long, 2″ wide in the center and 1″ wide at the ends. Fasten it in place with glue and small nails. All that now remains to be added are the triangular pieces shown by Fig. 3. They add much to the appearance of the clock and must be carefully shaped out. The nails that hold them in place, or perhaps it is best to insist on the slender screws, should be driven from the top and bottom flat pieces. In that way they will not be seen. Two coats of dark mission stain and one of varnish and wax will make a nice finish. If you prefer a gloss, use the

varnish and wax and polish with a soft rag. If you like the rich satiny appearance usually characteristic of high grade furniture, use only the wax and after it is on a few hours rub it to a shine with felt or flannel. It will present a rich and satisfactory appearance if finished in this way.

FOR MY CHUM

No doubt there is one lad who is your heart to heart friend and close companion. You will want to remember him in a manner



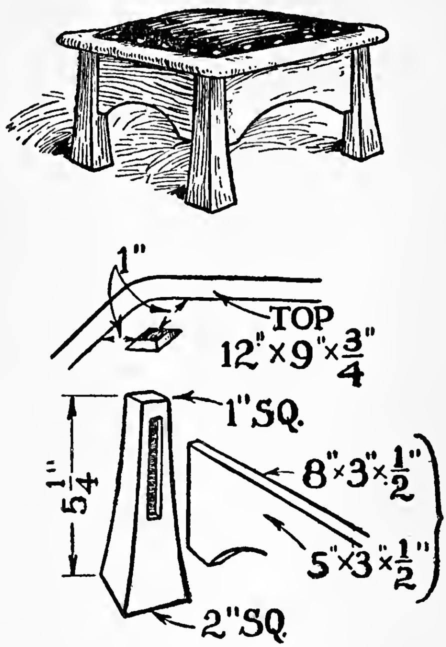
MATCH HOLDER.

befitting the season, so why not present him with this neat and practical match holder. It will be just the thing for his room and he will certainly appreciate it. There is no trouble in making it, but you must be accurate and painstaking. Four different sized pieces are used. Note the dimensions and the arrows leading from

them to the piece indicated. You should have them all cut to shape and carefully sanded before you start to put them together. Use oak and select the prettiest grain where it will show up best. For fastening together use large-headed upholstering tacks or round-headed screws. Finish it by staining a dark color and polishing with wax. If it is to be attached to a door or casing, leave holes in the center piece where they will be covered by the piece of sandpaper.

FOR GRANDMA

This substantial footstool is a thing of beauty as well as an article of real practical value. It will make an appropriate gift



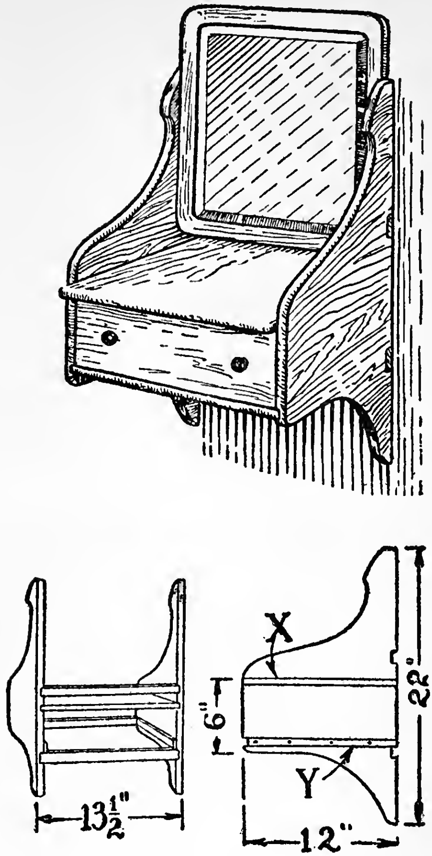
A FOOTSTOOL.

for your grandmother or grandfather. But little lumber is required, but it should be the best quality of oak. As the most diffi-

cult work is the making of the legs we might as well begin with them. In sawing each square piece to the tapering shape the main thing is to have them held firmly and to proceed slowly. Mark lines on all sides and after every third or fourth stroke of the saw look to see whether you are going right or not. Considerable time must then be spent in sandpapering the legs so as to remove all saw marks. The mortise is cut by boring a row of holes and then squaring up the edges with a small wood chisel. The rails that connect the legs are next. When finished, glue them in place, and while they are setting saw out the top. Note the holes on each corner of the under side of the top to receive the legs. The upholstering is done by padding the center and then covering with a piece of leather or suitable cloth. Large-headed tacks are used. The finish should be dark oak or weathered oak.

FOR FATHER

Your father will take more pride in your ability as a craftsman than any other member of the family, so you will want to do your very best in making this shaving cabinet. I think I have reduced it to the simplest possible lines without destroying either its beauty or utility. It will probably be a good plan to first buy the mirror you are going to use and then build the cabinet to suit its size. The size of each side piece is shown in the lower right-hand diagram. It is easy to cut out. "X" is a groove. "Y" is a cleat for the drawer to slide on. The top fits into the grooves, a glue joint being used. The back of the cabinet consists of two cross-pieces fitted into notches. They will be hidden when it is in use and may be bored so that screws can be driven through to the wall. The smoothing of the curved edges and the finishing must be slowly done if you intend to have your finished article a real success. In this case finish the same shade as the room in which the cabinet is to be used. The mirror is pivoted in the center and tilts both ways. The addition of two fancy hooks to the side of the cabinet might add something to its value. One would be for the the razor strop, the other for a towel.



A SHAVING CABINET.

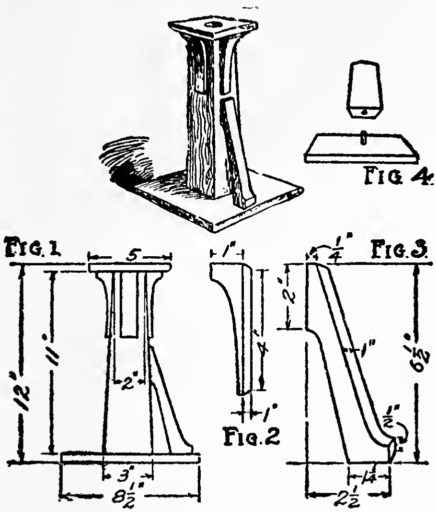
A MISSION CANDLESTICK

The vogue for mission articles continues and will probably always be with us. The reason for this is, that while other styles of an extreme nature erred by being too fantastic and complicated, the mission style, if it is wrong at all, errs on the side of simplicity.

Like everything else really artistic the mission idea in furniture has been abused and misunderstood, but there is now emerging

out of the chaos of designs a clear, pure type of home ornamentation that will last as long as lumber is obtainable.

The candlestick shown herewith is a good design for a beginner to attempt. It has very simple lines and is easy to make. The material used should be oak, walnut or maple. No doubt you can find some old table or bedstead or bureau that will, when torn apart, provide ample lumber to choose from. First cut a flat piece for the base $8\frac{1}{2}''$ square and about $1''$ thick. Square the corners to the best of your ability and smooth the top and edges with fine



A CANDLESTICK.

sandpaper until the grain stands out pretty and even. Now for the upright piece. A square table leg or bedpost would be fine for this, but you must cut it to taper from $3''$ square at the base to $2''$ square at the top. The way to do this is to mark it carefully on all four sides, then with a saw patiently cut away, taking pains to keep on the lines. The stiffer the saw blade and the finer the teeth on it, the more perfect will be your work. The upright piece as shown is $11''$ long. Again use your sandpaper by wrapping it around a small block and rubbing just where smoothing is needed. Be careful not to round off the corners, as that is a sign of careless

work. The flat piece for the top is next made and put on with glue and small brads, and then with a 1″ bit a hole is bored through it and into the post to a depth of 3″ or 4″. Getting the hole in the exact center is the point to be careful of. The base is nailed to the post by brads driven from the under side. Glue may be used to make the joint more perfect.

The shape and dimensions of the piece that serves as a handle is clearly shown in Fig. 3. It is hardly possible to make words convey a clearer conception of its appearance and purpose than this drawing does. The same may be said of the upper braces shown in Fig. 2. However, these pieces are the hardest to cut out on account of their curves. Don't try to make them too nearly right with the saw. Leave plenty to be sanded off and you will get better results. The braces and handle may be secured in place simply with glue or with long, round-headed blue screws. When working in hard wood always make a hole for a screw with the auger before attempting to drive it. Otherwise a split will be the result. When the parts are assembled give the whole a final smoothing to remove stains, and put on a coat of filler. Next put on a coat of furniture wax. This latter can be bought at any hardware store and gives a fine satiny finish.

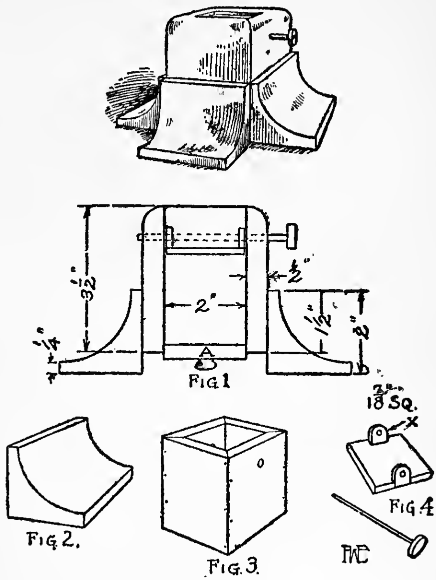
AN ASH RECEPTACLE

Here is a neat and practical article that will be found useful around any home. It is a little receptacle for cigar ashes and matches. As long as we have men we will have smokers, and something must be done to prevent the usual mussy appearance of the tables and stands caused by the same. The new feature involved in this plan is the tray which may be dumped by turning the key which sticks out of the side of the box. It keeps the rubbish hidden and when it becomes full the bottom is pulled out and emptied.

The first thing we will do is to make the four-sided box which is pictured in Fig. 3. You will note that the edges are mitered or cut at an angle of 45 degrees. If you have a miter box it will be easy to do this cutting, but if you have none at your disposal it will require some little time to make the parts fit accurately together. If you cut the pieces so that the grain

of the wood runs upright you can plane the edges. Pine is the proper material to use and the fastening is done with small brads. When the box is completed, get a piece of moulding and saw off four lengths 3″ long. One of these pieces is shown in Fig. 2. They are to go around the base and will add much to the appearance of the finished article. They may be either nailed in place or glued on. You should have a small bottle of liquid glue in your tool box ready for such occasions. Brush on a thin and even coat, and after it has filled up the pores of the wood and hardened, put on a second coat and clap the pieces together. They should be left under a weight or pressure of some kind for a day.

Now we come to the interior of the receptacle. The tray may be fashioned out of a piece of cigar-box wood. Figure 4 is a picture of it and shows also the key used to turn it. The key consists of a piece of wire with a button of wood for a thumb hold at the outside end. If you wish you may simply twist one end into the shape of a key handle. The bottom of the box is a removable tin disk. Get a flat piece of tin or any light sheet metal and bend up the edges enough to give it a hold when pressed in. A couple of coats of stain and a coat of varnish will be a suitable finish for the wooden parts.



AN ASH RECEPTACLE.

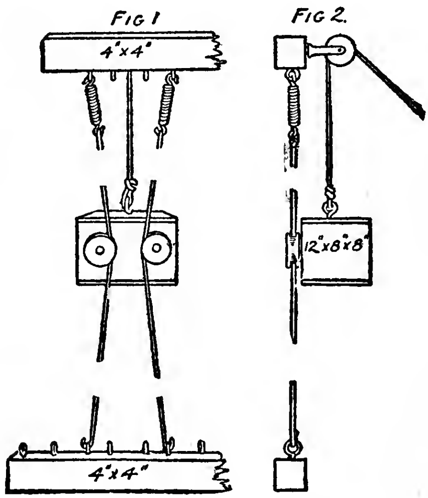
CHAPTER VI

The Boy's Gymnasium

A ROWING MACHINE

AN essential feature of the boy's gymnasium is the rowing machine. This apparatus is not so difficult to make as you would imagine.

If you study the complete sketch showing the boy operating the machine you will get the essential parts and the principle

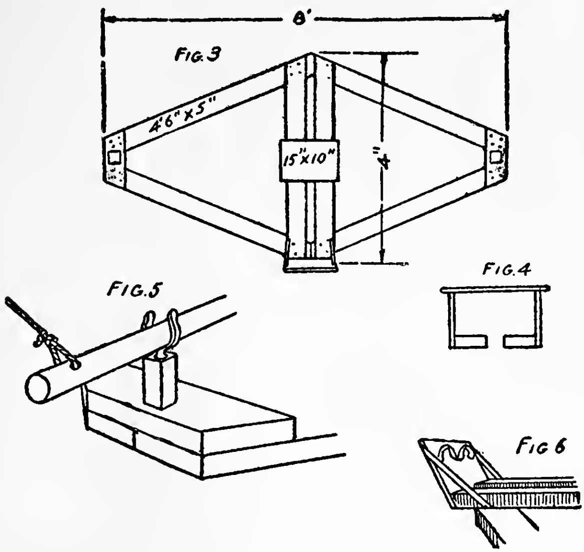


firmly fixed in your mind, and it will be much easier to understand the detailed description which follows.

First we will lay out the base of our machine, shown in Fig. 3. The bottom part is made of four planks laid out in diamond shape;

only two of the points are squared. Each of the four pieces that form it are 4′ 6″ long, 5″ wide and should be about 2″ thick. A short length of the same material is screwed to each side to hold the planks together, and also to form a bearing for the lever pin. At the center two more planks are placed across the diamond frame, from front to rear. In the center of the diamond and on top of those two cross planks is a heavy oblong piece for a seat rest.

Figure 4 shows the construction of the seat. It is simply two upright pieces with a plank across. It may be padded or a better



way still is to have a rather hard cushion for the purpose and simply tie it on. Figure 6 shows the foot-rest. It is too simple to require any explanation. Glance at the picture and you will see its object and principle instantly.

The lever and its bearing is very easy to understand and build. The bearing is a 2″ square block about 4″ long fastened securely to each side of the diamond frame. A hole is bored in the top of it and into this hole a common oar lock, used in row boats, is fitted. It should turn freely, but not be loose enough to shake in the socket.

The upper or U-shaped part of the oar lock is fastened permanently to the lever which takes the place of the oar. The lever consists of a baseball bat or a stick of wood similarly shaped. To the end furthest away from the hand a cord or flexible wire is attached. A complete plan of the lever is shown in Fig. 5.

We will now follow the cord after it leaves the end of the lever. This is best done by referring to the complete sketch. You will see that it passes under a pulley which is attached permanently to the floor, then to the top of the machine, through another pulley and down to the weight, which is pulled up and down when the machine is in use.

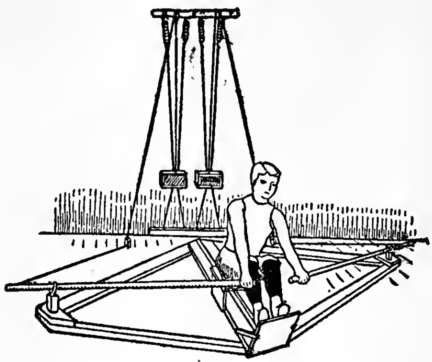


FIG 7

The weight and wire runway are made as follows: First, spike a piece of 4″ x 4″ stuff to the floor and wall, directly back of the center of the frame. Its length is 36″. A similar piece is securely bolted to the wall about five feet above the floor. To the top of the lower one fasten a number of staples or screw eyes. To the under side of the high piece in Fig. 1 a similar number of staples or screw eyes are driven. Wires, upon which the weights slide, are hooked to those staples, from top to bottom. At one end of the wire a spring should be placed to give it some elasticity.

The weight consists of a box which may be filled with any heavy material. Two wooden spools are fastened to the rear side so that it will roll more readily along the wire.

The purpose of having more than one staple to attach either

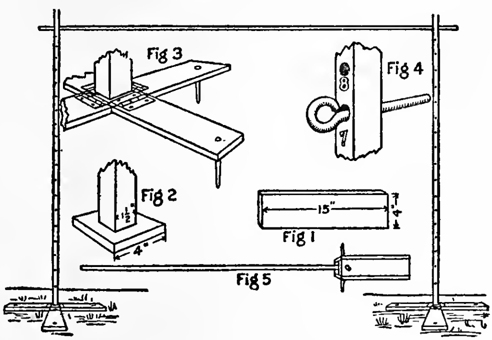
end of the wire to is so that the machine may be instantly adjusted to boys of different physique. When the wires are parallel it is quite easy to pull the weight up, and it has a tendency to drop too quickly upon the recovery stroke. By widening the distance between the wires at the top even the empty box is hard enough to pull up, and of course, having little weight, will not drop heavily.

A very complete plan of the wires, weights and attachments is shown by Fig. 1. Figure 2 is a side view of the same.

When the wires are parallel the machine may be used as a chest weight machine. In fact, this machine constitutes a whole gymnasium in itself. Assuming that you will buy everything needed the cost will not exceed $1.50. Two or three boys should easily make one in a day.

THE JUMPING HURDLE

The jumping hurdle is a simple and practical article for indoor or outdoor use. Begin by getting two pieces $1\frac{1}{2}''$ square and $6'$ long. Bore eight inch holes through, spacing them an inch apart



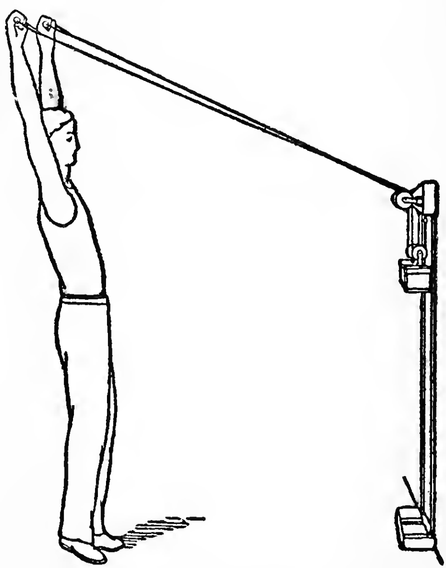
A JUMPING HURDLE.

at the lower end and a half inch apart at the upper half. Figure 4 shows a section with the holes bored and their use. We now nail a four-inch block on the bottom of each upright piece as shown in Fig. 2. When this is done we must saw off eight strips exactly like the one shown in Fig. 1. The dimensions are $15'' \times 4'' \times 1''$. Four of these are hinged to the bottom of each stander, being so

placed that they will swing up out of the way as shown in Fig. 3 and Fig. 5. For a cross-bar use a light stick 6′ long, preferably a piece of bamboo. A picture of the hurdle set up ready for use is shown surrounding the detail sketches just explained. The cross-bar rests upon pegs made of wire as in Fig. 4. The spikes shown in the ends of the 15″ strips in Fig. 3 are used to sink into the ground so that the upright piece will be firmly planted, but they may be eliminated from the plan if the jumping device is to be used exclusively for indoor use. Tinting the perpendicular strips with alternate blocks of red and white paint makes it neat and classy looking.

CHEST WEIGHT MACHINE

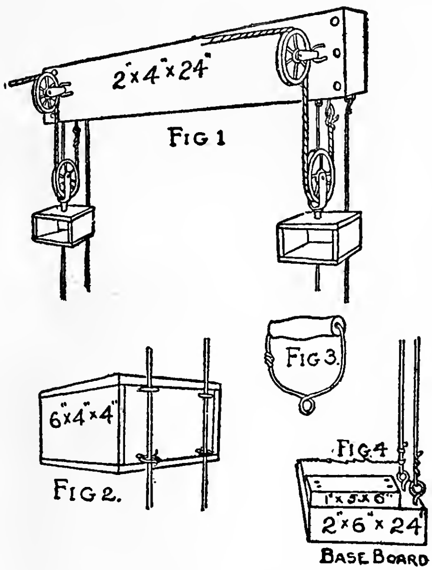
The chest weight machine shown here constitutes a whole gymnasium in itself. It is an original design, tested by several years of



A CHEST WEIGHT MACHINE.

continuous use, and it has few equals as a muscle-producer. The shop-made chest machines cost from $10.00 up, and are quite complicated and unwieldy. This one need cost you only 50 cents, will take up very little space, can be regulated according to your strength, is easy to move and can be used by every member of the family indoors or outdoors. The most appropriate place, however, is the barn or attic, and we will give directions accordingly.

The first lumber you need is a piece of sound scantling 2 x 4 x 24. It is well to smooth it with a plane and sandpaper on three sides,



PLAN FOR CHEST WEIGHT MACHINE.

letting the 4 x 24 surface that touches the wall remain rough. This scantling is firmly spiked to the wall at a height about even with your shoulders. You next procure two pulleys of the type shown in the drawing and fasten them with staples to the scantling. We will now make the base of our machine, which consists of heavy blocks that act as bumpers or rests for the weights. Figure 4 shows

the construction very clearly. If it is not convenient to get pieces of the dimensions marked, short lengths of plank or any scrap lumber you may have on hand will do quite as well. When finished the base should be fastened to the floor by driving one eight-penny nail at each corner down in a slanting direction into the floor.

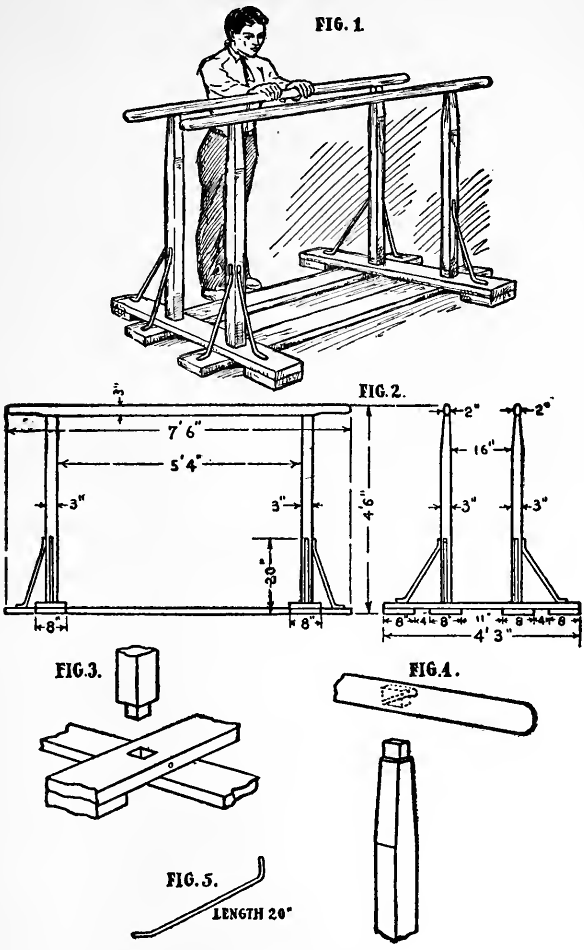
The next step is to string the guide wires from the top of the machine, Fig. 1, to the base board, Fig. 4. It is best to use heavy wire about the diameter of a lead pencil, but any of the smaller gauges will do in a pinch. The wires are secured to the wood with screw eyes as shown. One pair is placed at each side at about the distance indicated. The weight box shown in Fig. 2 is so simple that we need not describe it further. Note the screw eyes on the rear side through which the wires run. When in use this box, containing the weights, slides up and down and the wires prevent it from swaying or swinging. On top of each box a pulley is fastened as shown in Fig. 1. These pulleys will cost ten cents each at a hardware store, or five cents for the four at a junk dealers. The handle of the machine placed at the ends of the ropes is shown by Fig. 3. It consists of a pail handle threaded with light wire, which is bent into suitable shape. The manner of rigging up the rope is amply illustrated in Fig. 1.

PARALLEL BARS

To make the parallel bars described here a boy must have a good deal of faith in his own ability and plenty of perseverance. Every part of the work must be very carefully done, and with the idea of promoting strength and simplicity. The material must, on account of the strain it will be subjected to, be of the best.

We will start at the base. Four 2 inch planks 8 inches wide form it. The long ones are 7 feet 6 inches in length, the shorter two 4 feet 3 inches long. Lay out the planks to form a frame as shown, placing blocks 8 inches square under the shorter pair of planks. The measurements to guide you in laying out this frame are shown in the drawing. Spike the pieces firmly together and where the double thickness comes bore four holes as shown in detail Fig. 3. The holes go through both planks. The upright

posts come next. Figures 3 and 4 show the shape of the bottom and top respectively. They must fit tightly and stand perfectly up-



PARALLEL BARS.

right. You will have to try over and over again to accomplish this result, but the training to accuracy that this alone will give

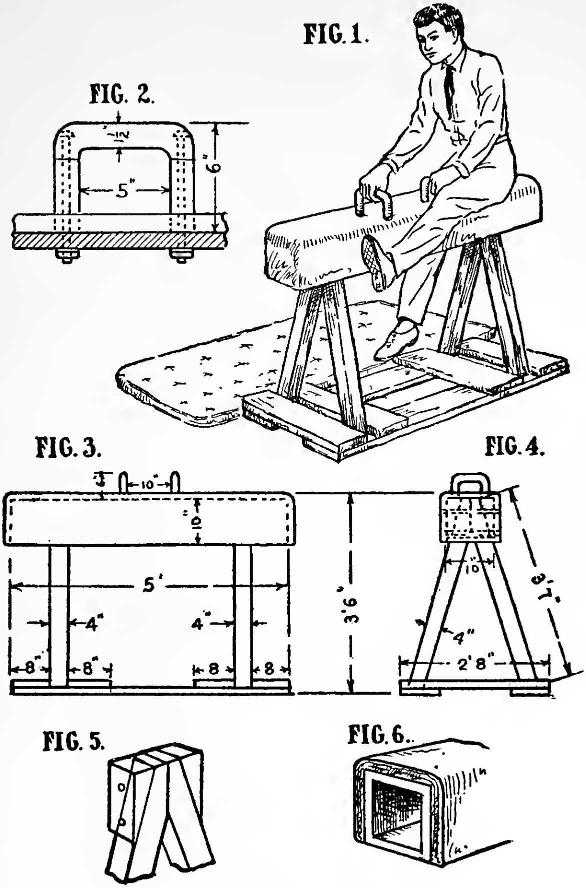
you is worth a good deal. Use glue at both joints, and reinforce with nails driven in at a slant as in Fig. 4. The metal braces shown in Fig. 5 are next screwed into place. Besides supporting against strain, they should tend to keep the posts vertical. The bars at the top should be of selected straight grained hickory. It takes some time to get them smooth enough for this purpose. Sandpaper carefully with the finest grade of paper, using lastly the sheets that are well worn, and apply spar varnish or linseed oil. These bars are simple, strong and serviceable. You will find such apparatus in use in nearly all gyms throughout the country.

VAULTING HORSE

Here is another standard gymnasium article that you can make at very little expense, save that of labor. It is a vaulting horse of the type commonly seen in large athletic club rooms. Figure 3 is a side view and Fig. 4 is an end view.

The thing to begin on is the base, which consists of a rough framework of planks. The planks used are 8″ wide and 2″ thick. Lay two 5′ lengths parallel on the floor, with a space of 10″ between them. At each end nail a short length of plank even with the corners. Now take one pair of legs of the saw-horse, like Fig. 4, and rest it on the long planks so that the side of the legs touch the short planks, to which they are nailed. Do likewise with the other pair of legs. Now lay on the other two short pieces of plank as clearly portrayed in the finished drawing, Fig. 1. The planks are spiked into place and we are now done save for the top of the apparatus. The top of each pair of legs is shaped like Fig. 5. The upper part of the vaulting horse consists of a long, strong box padded with carpet and canvas as in Fig. 6. The handholds are put on before the padding. They may be made of large, heavy bolts bent by a blacksmith to the shape of an inverted "U," or they may be of wood held in place by upright bolts, as shown in the detail cut, Fig. 2.

The stunts which may be performed on a vaulting horse are varied. Like anything else, use will suggest many new things to you. No gymnasium is complete without one.

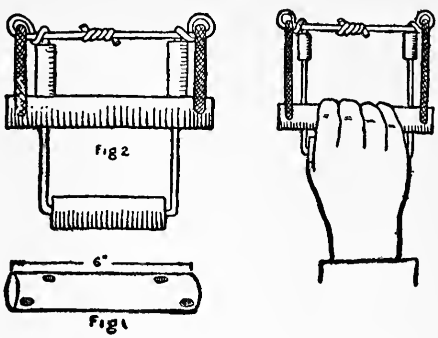


VAULTING HORSE.

A GRIP MACHINE

The little device shown in the accompanying cuts is called a grip machine because it is intended to develop the strength of the wrist and fingers. It is used by being grasped in the hand and squeezed until the two cross-pieces of wood touch each other. The fingers

are then relaxed, and the tension of the rubber brings the parts back to the normal position shown at Fig. 2. The motion is then



repeated until the hands become tired. You might think this would take a long time, but if you can squeeze the machine thirty

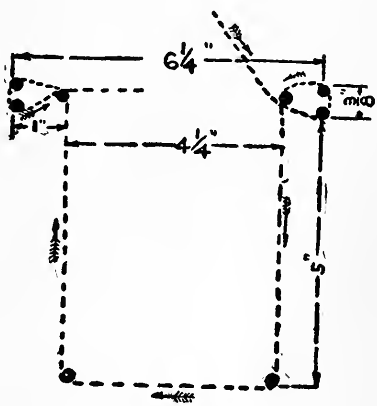


Fig. 4

A GRIP MACHINE.

times at the first trial you are doing very well. It is interesting to use it every day, so you can see just how fast your strength is

increasing. All athletes in regular training use the grip machine because it develops a most important set of muscles not specifically reached by any other device. It is also believed that it prevents stiffness and knottiness of the arm muscles. The wrist and fingers are the weakest parts of nearly every one, and as you well know, a chain is only as strong as its weakest link, it behooves you to make the device.

Figure 4 is a diagram which shows how the wire is bent. The heavy black dots shown are nails driven into the board, and should be spaced exactly as noted. The dotted line is the wire. It begins at the right-hand corner, and follows the direction of the arrows. This is the quickest and surest way to bend the wire properly. Figure 1 shows how the longest cross-piece has to be bored to receive the wire and rubber. The other parts are a wooden handle and two small round-bored pieces for stops. The rubber, which can be purchased for five cents, is fastened to the loops, which have been twisted in the corners of the wire frame and to the sliding stick.

METHODS OF HANDLING THE PUNCHING BAG

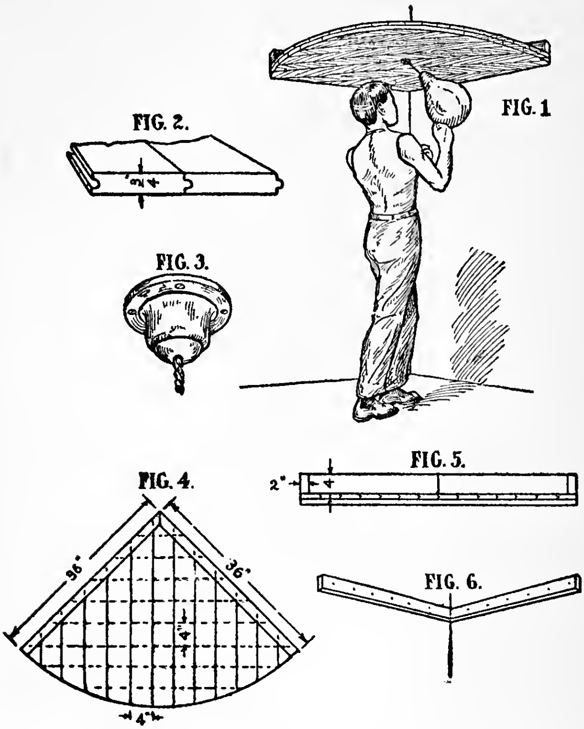
PUNCHING BAG DRUM

For a long time the punching bag has been recognized as one of the best aids in developing speed and grace, as well as strength. There are many different kinds of drums or striking surfaces in use, but for a plain, everyday boy, who must use the wood shed for his gymnasium, the one shown herewith is recommended. It consists of a double thickness of matched boards which is nailed to a strong frame erected in the corner of the barn.

First tack your scantling in place as shown in Fig. 6, and nail two light strips across them, on the top side. This is done to make sure that the frame will fit in the corner after the matched boards are nailed to it. Now draw the nails that hold the scantling to the walls, and lay the frame on the floor, the light strips mentioned being on the ground side. Now nail on the half-inch pine flooring, taking great pains that the nails and all other inequalities of surface are hidden. The second layer of boards is laid across the first. Save your best and smoothest boards for this last course.

Several coats of shellac or linseed oil are given to the striking surface.

You will need several boys to help you hold the disc up while the scantlings which form the frame are spiked securely to the walls. The height from the floor is governed by your own stature.



PUNCHING BAG DRUM.

The strap on which the bag hangs is generally 4″ to 6″ long, and the bag itself should have its center on a level with the eyes of the person using it. It will be a good safe way to screw on your swivel and hang the bag therefrom before you erect the drum. Then you can determine the right height by standing and measuring with your eyes, as explained, while others raise the frame to suit

you. It is well to make a small platform for your young brother or any small lad to stand on when he whales the flying pellet.

A PORTABLE PUNCHING BAG DISC

Here is a punching bag drum which any handy lad may construct in his spare time. It is made of light stuff and can be taken down, folded and stored out of the way without much trouble. This feature permits the disc to be put up in the middle of the barn or lawn or cellar as the case may be. Begin work by cutting out the circular form that is to be used as the drum or striking surface. Lay your 1″ pine boards flat on the floor alongside of each other, placing them as tightly together as possible and tacking to the floor solidly enough to prevent the possibility of the boards shifting. Now draw a circle by means of a small strip which has a nail driven in each end. About 36″ is the length of diameter, the strip you use for describing will be equal to the radius, or 18″.

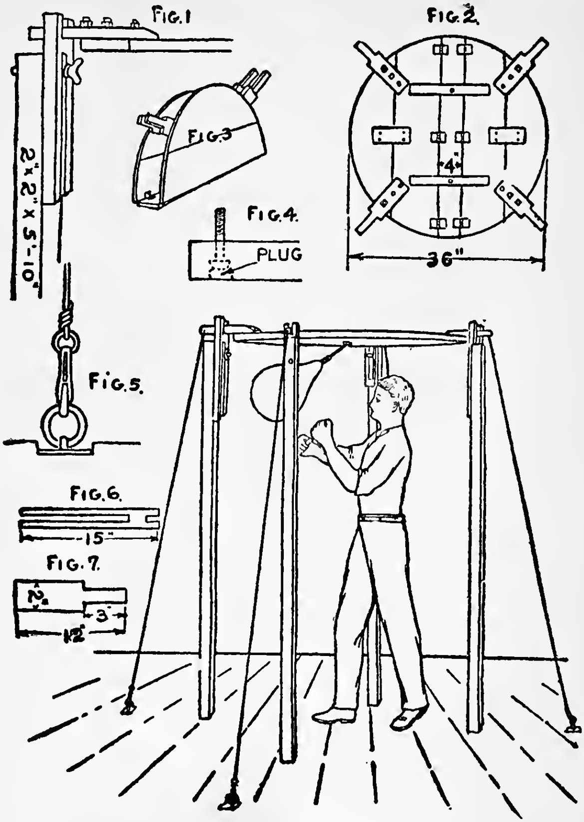
The boards are now cleated together except the center, which is provided with hinges as shown in Fig. 2, so it may be folded up as in Fig. 3. If you wish you can dispense with the hinges and use strong cleats that go all the way across. Four blocks of the size and shape pictured by Fig. 7 are firmly screwed to the disc at each quarter of the distance around. They will rest upon the posts that support the drum. Figure 2 is a complete plan of the disc and shows the reverse side, that is, the side which the bag does not strike.

The posts are 2″ square and of any desired length. A slotted piece like Fig. 6 is fastened to the top end of each. The long slot in this piece permits it to be raised or lowered at will. It is held tight at any height by the wing nut shown in the cut. Figure 1 shows every detail of the post construction. It is an ingenious and very strong device. By studying it a few minutes you will get the idea firmly fixed in your mind.

Figure 4 shows how the bolts in the face of the drum are sunk beneath the striking surface and then plugged with wood.

We will now suppose that the drum is resting on the posts. If we tried to use it in this shape we would find that it lacked firmness and stability. This fault is overcome by the wires strung from the top of each post to the floor. Steel snaps, used commonly on the ends of hitching straps, are placed on the end of the wire, and hook

on to staples or rings in the floor. That about completes the drum save for the finishing of the surface. This is done by sanding it



PUNCHING BAG DISC.

thoroughly and applying two coats of shellac. This punching bag device is superior in many respects to any on the market.

OTHER WAYS TO DO IT

This striking bag has the happy faculty of bobbing up again no matter how hard it has been knocked down. The first thing

FIG. 1.

FIG. 2.

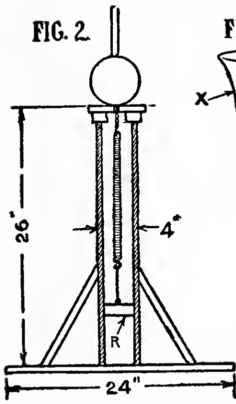


FIG. 3.

FIG. 4.

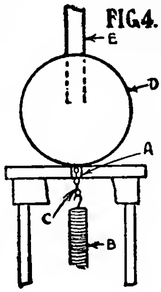


FIG. 6.

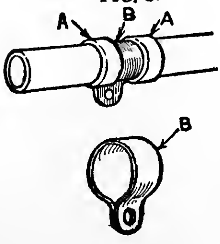
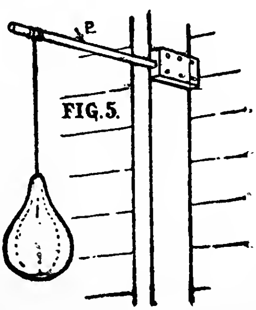


FIG. 5.



to do is to erect a hollow post made of 4″ pine boards after the manner of Fig. 2. It sets upon a cross which is screwed to the floor, and is well braced with set pieces as shown. Finish it entirely, with the exception of one side, which is left open. We then nail in the solid block "R" and attach the lower part of the spring to a screw in its center. In Fig. 4 "D" is a heavy ball, "A" is a short chain leading from it, "C" is the hook and "B" the upper end of the spring. "E" is the wooden pole upon which the punching bag is mounted.

In Fig. 3 "Y" is the same pole and "X" is a tin or leather horn which fits inside the neck of the bag, but not the bladder. When this arranging is done, nail the board on the open side of the box in such a way that it may be removed without trouble. You can set up your common bag in this way and no doubt will enjoy the change.

Another new punching bag stunt is shown in Figs. 5 and 6. In this case instead of striking a drum or bobbing back the bag turns a complete circle around the shaft from which it is suspended. It works with nice regularity and permits the use of a great variety of exercises. The shaft is a piece of half-inch gaspipe with two couplings or sleeves, "A," on it. Between those is a swivel, "B," which must turn freely and not bind on the couplings. The end of the pipe, which is attached to the corner of the building, should be flattened a little and set into a hole of oval shape. If it is left round it will turn with the motion of the bag.

CHAPTER VII

Interesting Toys

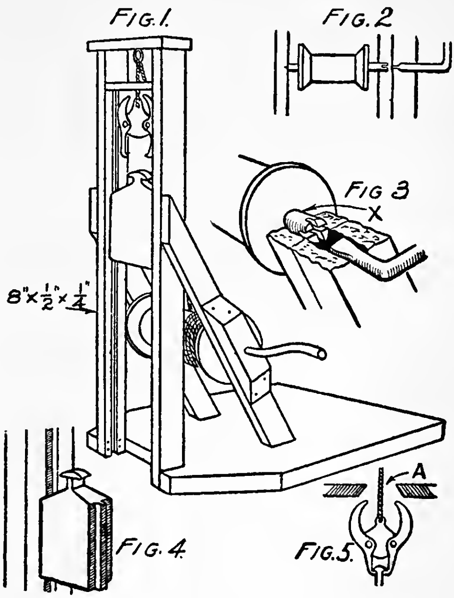
PILE DRIVER MODEL

One of the first things that a boy of mechanical ingenuity will do is to study the machines and contrivances he sees and then try to imitate them in small working models. It is good practice, too, for it teaches first principles far better than they can be gleaned from text-books. One of the most interesting and at the same time simplest of ordinary devices is the pile driver. Wherever one is working you will see a crowd of spectators intently looking on.

This plan has been made as simple as possible, omitting the high rigging and other unnecessary parts and confining it to the working principles. Let us first construct our frame work. It must be done accurately if we expect good results. The base may be a 1″ pine block about 10″ square. The two uprights are 8″ x ½″ x ¼″. Note the way they are fastened at the bottom. Small brads or a few nails from a cigar box are used. The grooves in the inside surfaces are to permit the weight to slide up and down. The cutting of those grooves is a matter that will test your patience unless you have a small set of gouges. The boys who have not this advantage can score them out with a pocket knife by going slowly and methodically at it. Mark out your lines and dig away with the point of the blade and you will soon have it properly done. For smoothing and finishing wrap a quarter or half dollar in a small piece of sandpaper and rub the edge of it thoroughly.

The slant pieces act both as braces for the uprights and as a support for the spool that holds the rope. The bearing, or part upon which the axle turns, is shown clearly in Fig. 3. The wire used for an axle fits tightly into the spool so that when it turns it will bring the spool with it. In the end of the axle, "X," file two slots and make the end of the crank chisel pointed enough to fit it. At

the top of the frame you will notice a small ring through which the line passes. Under this ring is a secondary cross-piece. In the cross-piece is a slot $\frac{1}{8}''$ wide and $\frac{1}{2}''$ long. It is beveled or cut slant as shown at "A," Fig. 5. The clutch or jaws that grip the weight are shown also in this cut. The jaws are pieces of sheet metal cut out with a chisel or shears and finished by filing. They are riveted in the center to another piece of metal of weight enough



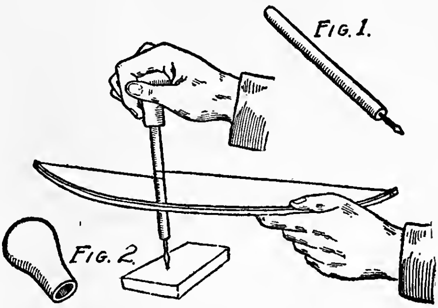
PILE DRIVER MODEL.

to carry itself down. The rivets should be loose enough to permit the jaws to swing freely. The weight of the jaws are supposed to cause them to drop down and slip over the top part of the sliding weight that does the driving. When it has gripped it, you wind up, and the weight is carried to the top of the frame. There the top part of the jaws will enter the slot "A" and will be pinched together. This will cause the bottom parts of the jaws to spread apart and the weight will be released and drop. Then

you let go of the crank, and the jaws, by virtue of their own weight, will fall and again clutch the hammer. This hammer or heavy weight can best be made by getting a piece of lead or solder at the hardware store and filing it to shape.

FIDDLE DRILL

Here is an old-time mechanical device that will be found useful in your work shop. It is called the fiddle drill. It is a very handy tool with which to drill through glass or sheet metal. The bow is a piece of bent hickory with a good stout cord tied from end to end. The drill point may be made from a file. Heat it cherry red and plunge it into beeswax again and again until it is cooled.



FIDDLE DRILL.

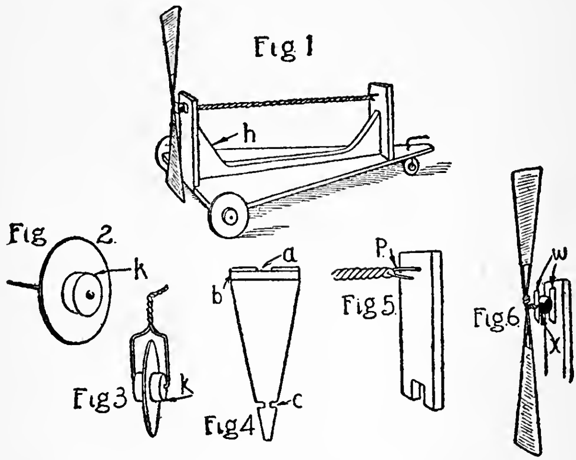
This makes it hard enough to take hold of glass. The point is imbedded in wood. A cap piece fits over the top and is held by the free hand. By pushing the bow back and forth the drill is rotated rapidly and soon begins to bite into the metal. It is a simple device and it will pay you to experiment with it now, so that when an emergency demanding its use arises you will have it in readiness.

THE WIND WAGON

We show you here a new and superior type of that interesting toy that has been called the "wind wagon." It is just the thing for beginners in aeronautics to experiment with, as it teaches the use of the propeller and the rubber-band power plant. If it has

been carefully made the wagon will run nearly a hundred feet over a level surface with one winding. The point for you to understand is that the motion of the propeller flying around pulls it along just as a propeller forces a boat forward by its spiral motion through water, which, of course, has a greater resisting power and consequently a greater driving power.

So far as the editor knows there are only two positive driving powers known, the wheel on a solid surface, and the propeller in a gaseous or liquid medium.



THE WIND WAGON.

The first thing to do in making the wind wagon is to cut out a three-cornered piece from a cigar box cover. It should be 5″ long and taper in width from one-half inch to 3″. Next cut the two upright pieces that go on the ends. Figure 5 shows the shape of the finished piece. The complete sketch shows how they fit on. The height of each should be 3″. Between those two upright end strips we place a long strip to brace them and overcome the tension of the rubber band. Now put on your wheels. The front pair are tin disks bored with a piece of cork on the outside and a common pin for an axle. Each one is made and put on separately. They should move very freely and should rest even. If one is lower than

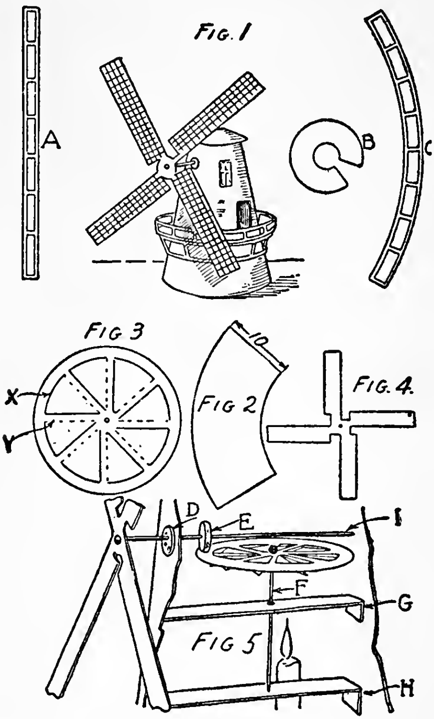
the other the wagon will go in circles. The hind single wheel is made of a smaller tin disk, with bits of cork glued to the sides and a bent hairpin for an axle. Figure 3 shows it clearly enough.

The propeller is made of fine wire twisted into shape and covered with tissue paper or silk. It might be cut out of wood. The shaft passes through two tin washers, marked "W" in Fig. 6, and between the washers is a bead, marked "X" in Fig. 6. The bead is simply to lessen the friction and gives greater power. The rubber band is fastened to the shaft and to a staple in the rear upright piece. To make the wagon go you turn the propeller until the rubber is twisted tight and then suddenly release it. Some prefer to use more than one small rubber band in preference to one large band. A wind wagon of any size may be made on the same principle, but, of course, in a really large one you would have to have an engine for power. You may place this toy on a small boat and it will propel it nicely. It demonstrates the great truth of propulsion through the air, and besides will yield you many happy hours both in the making and using.

A REVOLVING WINDMILL

A little moving toy that will yield pleasure and entertainment to every member of the family is here described. It is a windmill, whose blades will really turn in a most natural manner. The device that gives motion to the wheel is the new and interesting part of the toy and it will be explained first. Figure 5 shows each part of the arrangement in its proper relation to the others, and I want you to study it until you feel sure that you understand it thoroughly. Observe first the flat, round disk of cardboard with the three-cornered openings in it. Figure 3 shows how to draft this out. The black solid lines are cut through, the dotted lines indicate where the blades are bent down to an angle of 45 degrees. Now a wheel or disk of this type will turn if placed over a candle, steam radiator, stove, lamp or anything else that is sending up a current of heat. Look at Fig. 5. Note the candle under the disk. It will turn and by friction or contact will cause the small cork pully "E" to turn. As the arms of the windmill are on the same shaft, they, too, will turn. Now, a word of explanation concerning the other parts of Fig. 5. "I" is the wire shaft, "D" is a washer

made of cork or cardboard, "F" is a small hatpin used as an upright shaft, "G" is a strip of cardboard with a hole in it, through which the hatpin passes and is thus steadied and held upright, "H" is a similar strip of cardboard, glued in, to form a resting place for the sharp point of the pin.



A REVOLVING WINDMILL.

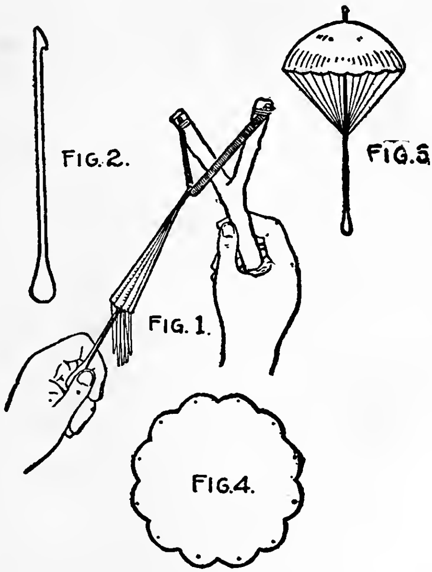
The cutting out of the parts that form the windmill will be easy if you follow the suggestions conveyed by the drawings. The large cylinder is shown by Fig. 2. You can tint it and cut in windows and doors to suit yourself. "B" is the conical roof, "A" and "C" are the railing pieces, Fig. 4 represents the arms or blades.

When you have it all made and the parts neatly and accurately fitted together, light a candle which is firmly held down and place

the lower end of the cylinder over it. If you have made it right it will turn evenly and continually until the candle is burned out. If it will not turn you may be sure that you have not done your work well, and a careful examination should bring the defect to light. As a preliminary experiment make a disk of the type shown and suspend it with a thread over the lamp. It will turn all right and will suggest to you a power that might be employed to make any number or variety of toys move.

A NEW PARACHUTE IDEA

The parachute, in its various forms, has always been a favorite with boys. The idea is to make an umbrella-shaped contraption



A PARACHUTE.

out of tissue paper and a stick, so that when it descends from any considerable height it will open out and float slowly to the ground. This part is easy enough. The trouble has always been in getting it up in the air high enough to repay one for his efforts in making it. Then came the idea that a common sling shot had propelling

power sufficient for this purpose and a little experiment proved that the thought was indeed a happy one. The combination of sling shot and parachute makes a very fascinating out-door amusement device. Every time you shoot it into the air you try to make it go higher than the last time.

To make the parachute, get a tough stick about 2 feet long and whittle it to a shape similar to Fig. 2. The bottom must be heavy enough to fall first, so that the parachute will fall in the right direction to be opened out. You can weight the end by tying a piece of lead or a spool on it. Cut your tissue paper to the shape shown in Fig. 4 and place a thread through every scallop. If the paper tears right through, a good plan is to reinforce the edges of the circle by pasting a strip of tough paper or muslin all around. A parachute made of silk or any fine mesh cloth will be much more lasting, but not quite as buoyant.

The sling shot is made with a large rubber band, some string and a forked stick. The greater its propelling power, the more successful will the toy be.

A HALLOWE'EN NOISE MAKER

Nothing is more appropriate for Hallowe'en than a good noise producer. The one pictured here is an improvement of the familiar tick-tack. Instead of being worked by pulling a string, as in the

FIG. 1

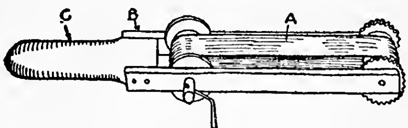


FIG. 2

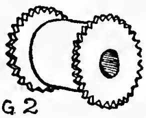
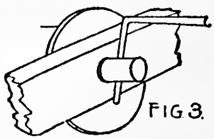


FIG. 3.



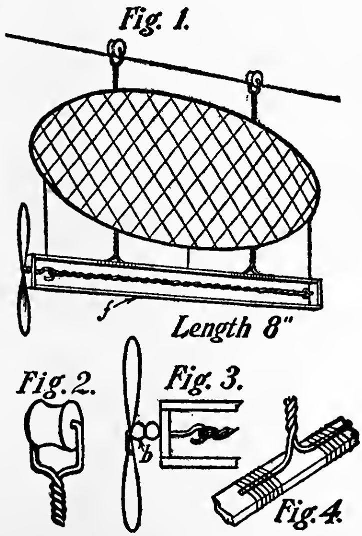
A NOISE MAKER.

case of the old device, it is given motion by turning a crank. First whittle out a nice handle "C" and nail to each side of it a small strip "B" cut from a shingle or cigar box. Next get two spools,

choosing rather large ones with deep flanges, and notch one of them with a sharp knife, as clearly shown in Fig. 2. Place the notched spool between the ends of the flat strips and fasten it there by using a bolt or spike for an axle. The other spool is inserted between the strips near the handle and a wooden axle is used. This wooden axle fits tightly into the hole in the center of the spool, but loosely enough to turn freely in the holes through the strips. A piece of bent bicycle spoke or any stiff wire serves for a crank. Figure 3 illustrates the driving arrangement pretty clearly. A belt made of leather or cloth is placed around both wheels. The toy is used by placing it against a window pane and turning the crank. A distressing, ratchety noise will be the result and you will probably have to scamper away quickly in order to escape some one's wrath.

A DIRIGIBLE

A dirigible balloon is a gas bag that is equipped with apparatus to control its motion. This little model looks like one, but it is

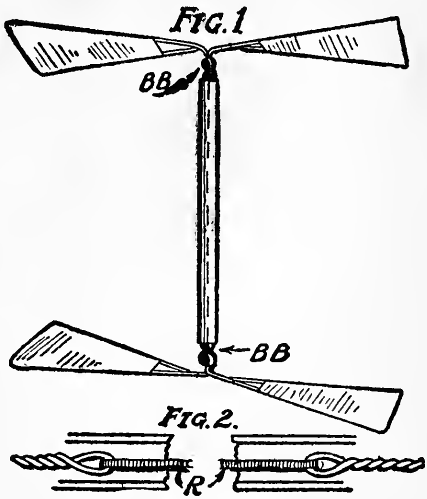


A DIRIGIBLE.

mostly imitation. The top part which looks like a gas bag is a flat piece of light board or tin, marked with lines as shown. It is suspended from a wire clothesline by means of two double wires. The top of each is fitted with a pulley made from a spool as in Fig. 2. The bottom or low end of each forks out and is tied to the framework as in Fig. 4. The frame is a long rectangle made of pine sticks. Inside of the right end is a hook, to which is attached a rubber band. The other end of the rubber fits on a wire hook, which in turn goes through the center of a small tin propeller. This is made clear by Fig. 3. The "b" shows two small glass beads used as bearings. Twist the propeller twenty times, then release it and the airship will run along the wire.

A FLYER

Here is a little flyer that is easy to make. The body of it is a three-inch length of tin tube of the size you often used as a bean



A FLYER.

blower. Upon each end of it is a tiny propeller fashioned out of a bent hairpin or, if possible, a piece of finer wire. The parts

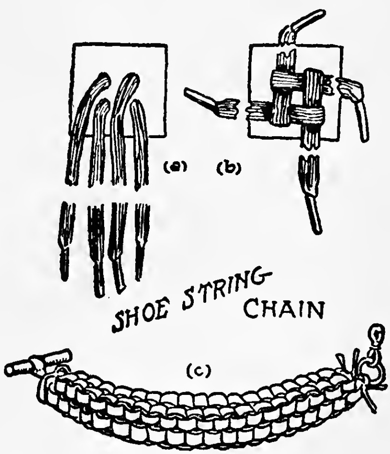
marked "BB" are glass beads used as bearings. Figure 2 shows a view of the inside. The twisted part at each end is the hairpin, the central section, marked "R," is the rubber band used as a power producer. To use the toy, twist the propellers in opposite directions and release them while the tube is in an upright position. The height to which it will ascend will surprise you. This little device illustrates the "pull" of the propeller used in aeroplane construction. The angle of the blades is the reason they go forward and drag the plane with them. As in flying a common kite, the tilt upward of the front end causes the forward motion of the plane to send it up. That is why you run against the wind. But make the little flyer and see for yourself. If you take pains to make it very light and use an extra strong rubber, good results may be obtained. It is a good experiment for builders of model aeroplanes.

CHAPTER VIII

Some Novel Ideas and Hints

THE SHOESTRING CHAIN OR FOB

THE drawings herewith show how a pretty and serviceable watch chain may be made out of a pair of common shoe laces. It is advised that all who wish to try the plan study the cuts carefully, as they show all operations far more clearly than words can. First secure a pair of new strings or, for a long chain, four strings,

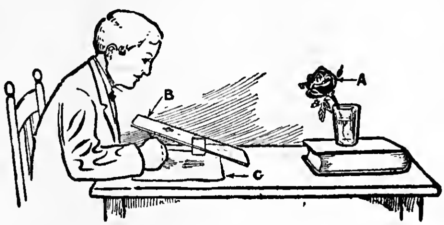


and press them flat. Now draw a half-inch square on a small piece of card board and punch a hole through each corner. Through these holes thread your shoestrings as illustrated in the drawing marked "a." Now the most important operation, that is the plaiting, is clearly shown in cut "b." The strings simply cross each other at right angles and you may begin with any one you choose. The fourth and last strand goes under the loop, the others

go over the next to them. When you have made the square shown in "b," double right back and continue the same simple plait. It should not take you more than fifteen minutes to complete the job. When the chain is finished it does not look cheap and home-made, but, on the contrary, appears very neat and classy. A pretty effect is obtained by using laces of different colors, white and black, brown and red, or having four colors. The chain is finished by sewing the ends with proper colored thread. The ring and bar shown in the lower cut are placed through the last loops of each end before the sewing is done.

A SKETCHING IDEA

Nearly every boy has some talent for drawing and it is important that this talent be developed. The picture shows a simple arrangement by means of which you can draw objects of simple outline. The glass plate "B" should be ground with a piece of emery cloth. You can buy ground glass that will answer your purpose better,



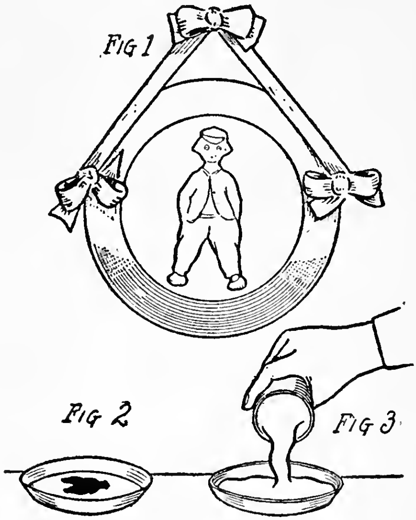
SKETCHING.

but any flat piece will do if it is rubbed with something gritty or rotated on a flat stone. When you have given it a dull surface, arrange it as shown in the sketch. A reflection of the object "A" will appear on the paper "C" and you can easily trace it. By this method you can draw the profiles of your friends and get a wonderfully lifelike result.

FRAMING PICTURES

Here is a little scheme that you should be able to use to great advantage in decorating your room. Briefly stated, it is simply

casting a frame of plaster of Paris around the print you wish to preserve. If the picture is a round one, place it face down on the bottom of a shallow pan, being careful to get it in the center, so that there is the same distance from any point on the outside to the rim of the pan. Next make sure that the pan is level. Now



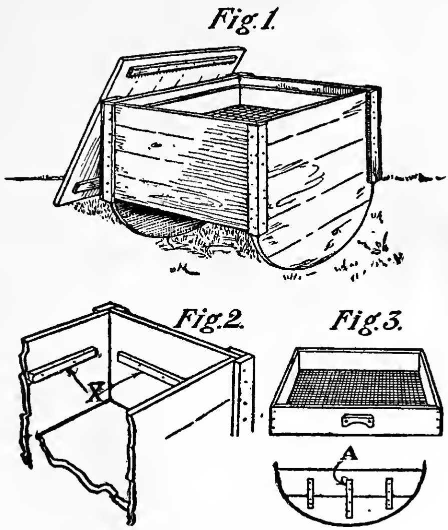
FRAMING PICTURES.

mix water with your plaster of Paris and be quick about it for it sets rapidly. When it is thin enough to pour, turn it into the pan and let the mass harden for about two days. It will stick a little to the pan, but by a little patient work on the edges with a knife you can remove it. You will then have a neat and serviceable frame. It can be tinted with paint or water colors.

ASH SIFTER

A simple ash sifter that will repay you for the time spent in making it is described below. Get a soap box and remove the top and bottom. Mark a curve along the lower edge of each of the ends and saw on it. This will cut away the pieces which hold it

together, and you will need to add three short cleats as shown in "a," Fig. 3. Nail small strips inside the box as shown by "x," Fig. 2. They are supports for the ash pan. The latter, a square frame with a screen bottom, is pictured in Fig. 3. All that remains



ASH SIFTER.

is to fit a cover on the box. The way to use it is to place the shallow screen box on the rests, cover it up and rock back and forth until the fine ashes have sifted through.

HOW TO REPAIR A CHAIR

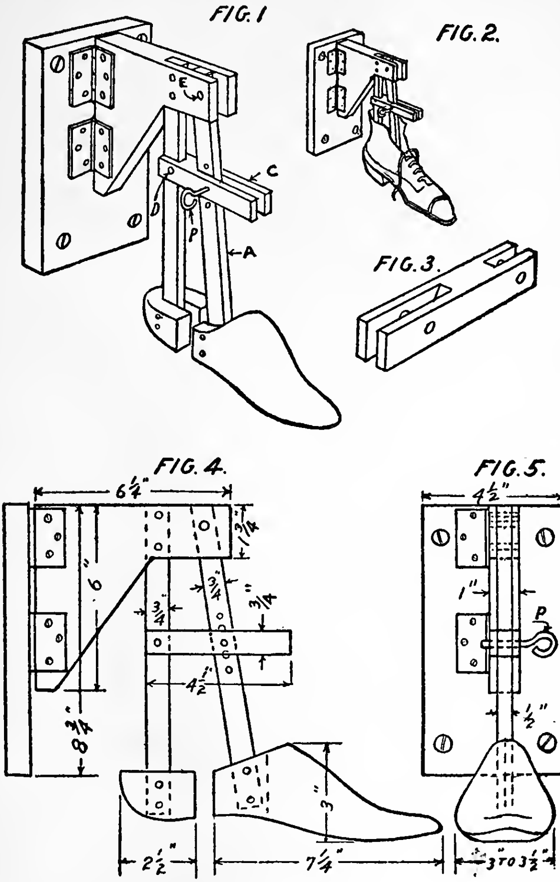
Many boys do not know how easy it is to repair worn-out cane seats in rockers and chairs or even replace them altogether, or we would not see so many of those saggy seats with holes in them. Boys! it is as easy as lacing up your shoes and a whole lot more interesting, for you can do the work as neatly as the most expert professional who charges your mother about seventy-five cents for a new seat in a chair or about a dollar and a half for a new back in the rocker.

All you have to get is the cane reed, and you can get all of this you want at the nearest basket weaving establishment or furniture factory for twenty-five cents a bunch. There is enough in each bunch for two seats and some will be left over. When you get the reed it will be tough and stiff and you can't do a thing with it until it has been soaked in water. Take the whole bunch to the kitchen and fill your mother's dish pan full of cold water. Be sure to use cold water; if you use hot or warm water you will ruin the reeds. Place the bundle of reeds in the pan of water and put a weight on top so that all the reeds will be under water—let the whole thing stand for an hour. After one hour's soaking you will be surprised how the reeds have changed, they are now soft and pliable, like shoe strings, and you can bend them any way you like and even tie knots in them.

The reeds will remain in this condition as long as they are water soaked and then is when you must weave the new chair seat. Examine the old seat carefully and you will see that the weave consists of two reeds side by side and then two more at right angles with about one-fourth of an inch space between each pair. This is carried out straight across the seat over its entire width and then again up and down, interlacing them at right angles. You must lace the reeds all in one direction first and then the next set crosses your first work up and down. This gives you square holes for openings. To make them octagonal, just like the original seat, begin at one corner and lace one reed diagonally across all the way down to the far corner; then begin at the opposite corner and lace back diagonally in the other direction. You will now see the little openings have eight sides just like the old seat had, and if you have been careful every one will be so perfectly shaped that an octagonal lead pencil will fit perfectly into each opening. But you say the seat you have just made is loose and sags some, not at all like the new cane seats should be. This will all come out in the drying, and you will be surprised in a day or so to find the new seat as tight as a drum head. All it needs now is a coat of varnish and your work is completed. After a little practice you will be able to weave two cane seats in one day just as good as the professional man, and your mother will be delighted to give you the price of the new cane seats.

SHOE TREE

If you have any uses for a serviceable shoe tree, why get busy, that's all. First, procure the block, which is screwed to the wall.



SHOE TREE.

It is 4½" wide and 9" long. Select a sheltered place on the rear wall of the house under the back porch, and screw it there, solid

as a rock. Of course you first bore holes for the screws, each being just the size of the shank of the screw, so that the thread only sinks into the wood. Also make sure that the screws go into a scantling and not the mere siding, which would not hold. You can easily tell where the scantlings are by noting where nails were driven to hold the siding on. Next begin to work on the piece which is marked "E" in Fig. 1. Saw it out of a piece of plank to the shape and measurements shown in Fig. 4. To make the slot or mortise, use a hand saw and wood chisel. Next find a pair of hinges and put them first on the slot piece and then on the wall piece. In Fig. 1 you can see just how it looks when they are hinged together. The three-cornered piece closes like a door. Next get a piece of ash as hard and tough as a bone and cut it to the shape shown in Fig. 3. The idea of the shape is shown by "C" in Fig. 1. The solid part of this piece, between the slots, is wedge shaped, so that when it is pushed up between the long sticks it has the same effect as a wedge. The sticks, "A" and "B," must be tough and durable. The inner one is fastened with two screws at the top and the outer one with one screw. "P" is an iron hook used to lock the parts in position. To raise "C" you must pull out the hook, and to hold it at any height simply poke it through another hole. The foot-shaped piece at the bottom of the movable strips can be easily shaped out of wood. Follow the lines of a shoemaker's wooden last, which you can see without trouble. The shaping is done with a pocket knife, round file and sandpaper. If it is to look neat it must be done slowly.

PART II

MISCELLANEOUS HELPS

CHAPTER I

Small Fur Bearers and How to Catch Them

In every rural community there are fur bearers to take, whose pelts are valuable. Most boys know that by a few hours' work, before and after school, they can make their spending money for an entire year.

In the first place, the skunk and civet cat become prime first—by prime is meant of first quality. After these come the raccoon, opossum, mink and muskrat. The last named fur bearer has not its best pelt until late winter and spring.

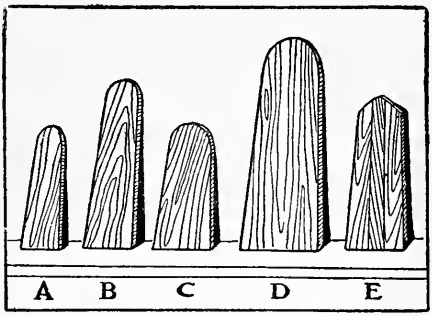
The skunk and civet prefer rough, hilly country for their homes. Along old hedge fences are excellent places to look for them. The raccoon and opossum are found most frequently in wooded sections, near flowing water. The mink has its den, as a general rule, on small meandering creeks, where drift-wood and weeds furnish it plenty of protection. Around old bridges, in tiles, etc., are excellent places for traps. The muskrat usually seeks to build its den or house in or near shallow water. As a rule, the dens are along flowing streams; the houses in ponds or lakes. All of these animals, with the exception of the muskrat, can be attracted by meat.

If new traps are purchased, each one should be carefully tested before it is set. If any are defective and cannot be fixed, they should be discarded. The loss of one prime pelt nowadays will usually buy a dozen good traps—sometimes even more. Remember this when making sets.

A good scent for the various fur bearers—the muskrat is not included—may be made as follows: Chop up some fish and place

the pieces in a common bottle. Let this stand in the sun until the contents are thoroughly rotted. A few drops of the fluid placed near a trap—never on the pan of it—will bring good results. Either Oil of Anise or Oil of Rhodium is considered a good decoy for the muskrat.

To conceal a trap properly for a land set an excavation should be made. Over the set place a thin piece of paper—dark color is usually best—and conceal this with dust, grass, leaves, moss, etc. For a covering use just enough to hide the trap, and no more. If too much is used, the action will be hindered; in all probabilities the jaws will not close. In this case the pelt is usually lost. It is also a good plan to cut or tear up grass or leaves used to conceal



a trap, for by so doing there is less chance of clogging it. And, by the way, make all sets in water whenever possible. Except the skunk and civet cat very few animals will be taken with land sets made by beginners.

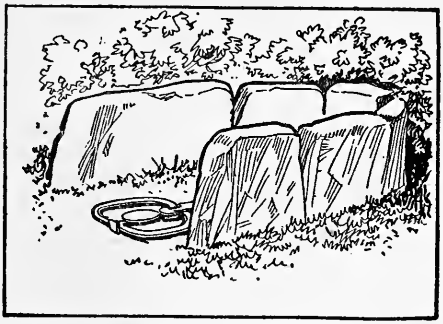
All pelts should be placed on a steel or board stretcher. While the former is recommended as best, the latter is more universally used. The illustration will show the shapes. Furs should be dried in a cool shady place, never over a fire or in the sun. Use no salt on the skins.

The skunk and civet cat are animals which are easily caught. Their animal instinct is not well developed; in fact, they seem to have no fear of traps at all. Sets may not be covered, yet it is always advisable to do so. Many a wise old mink has increased

a trapper's catch that was caught in a set made for the skunk or civet cat.

The easiest way to catch these animals is to place traps at the entrances to their dens, or in paths which the animals use. The two usually live in colonies, to a certain extent. That is, there are, in most cases, more than one or two to be had in the same locality. In fact, instances have been known where as many as fourteen skunks were taken from a single den.

If a den is found, build a small pen near it of brush or rocks, guarding the entrance by one or more steel traps. Back of the trap place a piece of bloody meat. Then the set is complete. Another method is to stake down a dead chicken or rabbit. Around



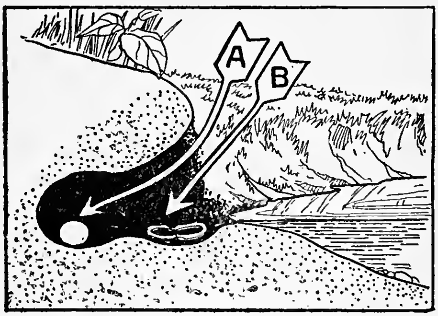
TRAP SET FOR SKUNK.

it set several steel traps, about eighteen inches from the bait. This is a favorite set with many professional trappers. Or in the brush, about a foot from the ground, suspend a dead chicken. Place traps near, about a foot or two from the bait. The set is then complete. Dig a shallow pocket in the side of a clay bank, and in the back part place some meat. Use one or more traps to guard the entrance to the pocket, as the case may require. This set is one of the best.

The muskrat is trapped by a greater number than all of those who seek the other fur bearers. It is found practically everywhere in America. A large percentage of the animals are speared each year. Usually a speared pelt does not command as high a price as one which is trapped.

The simplest way of taking the musquash—which is the Indian name for muskrat—is by locating slides and dens and placing traps at the foot of the former and in the entranceways of the latter. The traps in either case should not be covered by too much water. Many men prefer about three inches, as the animals are usually caught then by a hind leg, which renders it almost impossible for them to escape. Some trappers prefer the No. O traps for taking the muskrat, as they do not break the bones in an animal's leg when they snap upon it.

Dip a small twig in Anise Oil and stick it, the end containing the decoy, about six inches above the water, where the stream or lake is very shallow. Incline the stick, placing one or more traps



A TRAP FOR SKUNK SET IN A CLAY BANK POCKET.

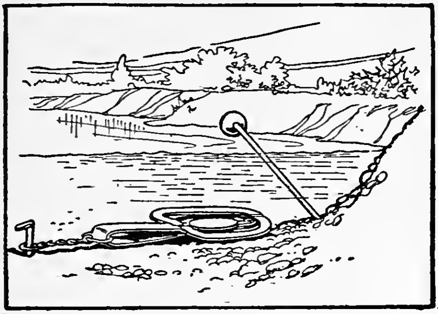
almost directly under the end of the twig which contains the scent. This set may be relied upon at all times if care is taken that the water does not wash the decoy away.

Place a parsnip on a stick, making a set similar to the one described. Upon the parsnip place Oil of Rhodium. If two shallow pools of water can be found which are connected by muskrat runways, these trails are excellent places for traps. Often a dozen catches can be made within a few feet in one night. On leaves which overhang the water place a few drops of Oil of Rhodium. Set traps in shallow water near them. Sets made in this manner often bring splendid results.

It is well to place the stakes to traps set for the muskrat in deep water, though the trap itself should be covered by only about

three inches. Then when one is caught it will, in many instances, drown if the water is deep enough to cover the animal.

The mink is one of the hardest of all fur bearers to trap. Its animal instinct is so well developed that it takes the greatest



PARSNIP BAIT FOR MUSKRAT.

ingenuity of some of the best trappers to get its pelt. It is not recommended that the amateur risk many land sets when after mink. In case this kind of set is used, the trap or traps, as the case may be, should not be handled with the naked hands. Gloves

A TRAP SET FOR MINK.

with the palms coated with beeswax are advised. They should be used for no other purpose than that of setting and handling traps. Remember, in making all sets, everthing should look as natural before as after the traps have been placed. One learns

the value of this truth when after mink, for if it is not observed the result will be failure.

A good method is to locate a runway which leads into the water, and place a trap at the foot of it. Excellent places may be found around old bridges, roots of trees, etc. Traps concealed at the entrances of tiles make the best sets for this animal.

Dig shallow pockets into the bank of some small stream, just at the edge of the water. Have the back of the excavation higher than the front, so it will not be flooded with water. In this pocket place a piece of meat or fish. One trap, its spring covered with mud and just within the pocket, should guard the bait. Stake a piece of meat near the edge of the water, and build a small pen around it with rocks. Leave two or three entrances between the stones. In these place traps. It is well to cover the whole set with grass or light brush. In making sets of this kind, do not leave tracks in the mud near the traps. Further, drench the set and shore touched near it with water, so the human scent will be destroyed. A similar set may be made on shore with a dead chicken for bait. Use the feathers for covering the traps.

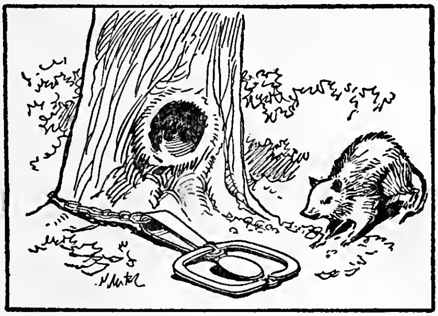
The raccoon is easier to take in steel traps than the mink. It is very strong and a set for it should never be staked. Again, a bush fastening, unless large, should not be used, otherwise the trapper is likely to bemoan not only the loss of a pelt but a trap as well. The raccoon has powerful and sharp teeth, which it can use to a good advantage.

The easiest way to take the raccoon is by a water set, made similar to those already described for mink. Use fish for bait. Along sand bars are favorite places to take the animals. Build pens facing the shore or bar, using apples or corn for bait. On stones nearby, where the water will not wash it away, put a few drops of fish decoy, if any has been made. Traps may also be concealed in paths which the animals make into corn fields. No bait is needed for a set of this kind. Sometimes pens like those already described may be used successfully. Build them near the 'coon trails—not on them. At the mouths of creeks, along old logs, around driftwood, etc., are ideal places to make sets for these animals. The opossum is easily taken, although its pelt is not very valuable. It is designated by the trade as "cheap fur." Make sets in leaves in localities which the animals frequent.

Suspend a fish about eighteen inches from the ground. Place a trap, properly concealed, close to it.

Many trappers ignorantly claim birds are good bait for the 'coon and 'possum. This is not true. A bird of any kind is about the poorest of all meat baits. Do not experiment and lose valuable pelts. A trapper who tells you to use a bird for bait, not only for these but for other animals, is one who knows nothing about taking the pelts of fur bearers. Not as large a trap need be used for the opossum as for the raccoon.

Do not be too enthusiastic about trapping, and start in on too great a scale. Purchase only a dozen or two traps to begin with; if you need more they can be gotten from time to time. Make every set carefully. It pays in dollars and cents. Sets should be



AN OPOSSUM TRAP.

visited every morning. It is best to remove all pelts from carcasses as soon as possible. If left too long, the fur frequently becomes tainted. Many times fur bearers will be found frozen in traps. Do not attempt to thaw them over a fire; instead, place the animals in cold water until they can be skinned. Do not leave traps out too late. The skunk and civet cat become "springy" early in the season. By "springy" is meant begin to shed, lose color, etc.

The best way to kill a mink is by stunning it with a club, and crushing its ribs in. Never smash the skull of any fur bearer, if possible, for by so doing a clot is left on the pelt. This does not directly affect the value of the fur, yet it is to the trapper's advantage to have his catch look as well as possible.

Do not start out too early in the season after pelts. One prime one is worth a dozen which grade as "trash," usually. Do not make sets for such animals as the mink on land without the use of gloves. Do not set a trap until you test it before placing it in position. Some become defective after having been used once or twice. Do not remove a trap to another place because one animal has been caught. The chances are you can get two or three by letting it remain.

CHAPTER II

How to Run

NEARLY every boy can improve his style of running and increase his speed if he will practice a little. It might seem that running is purely a matter of strength and wind, and that people who have lived in the open air for generations, and who, like the American Indians, take a pride in manly strength, skill and speed, should be, almost to a man, the finest of runners. The Wild West novelist loves to introduce an Indian brave who runs with the grace and speed of a deer. But, as a matter of fact, the white man who can bring science to aid his muscle is more than a match for the Indian runner in all but the longest of the distance races. In a relay, or team race, in which the four fleetest Indians from the Carlisle

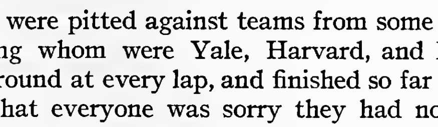


Fig 1

Indian School were pitted against teams from some of the eastern colleges, among whom were Yale, Harvard, and Princeton, the Indians lost ground at every lap, and finished so far behind all the other teams that everyone was sorry they had not been pitted against some of the teams from the preparatory schools like Swarthmore and Haverford.

While instruction in running ought to be personal and adapted to the peculiarities of the pupil, it is possible to point out a few of the more common faults and show how to overcome them. Let us consider, first, the *feet*. Almost every boy naturally turns his feet out. His feet are the reverse of pigeon-toed and in walking he makes tracks as in Fig. 1.

When he runs this tendency is often exaggerated. Now suppose one foot is planted on the ground as in Fig. 2, in which the arrow shows the direction in which the runner is going. If he had planted

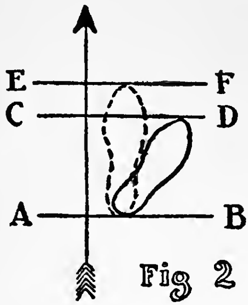


Fig 2

his foot pointing straight ahead, as shown by dotted foot, his next step would start on the line "E–F" instead of on the line "C–D." The distance gained in this way generally amounts to about an inch and a quarter. Supposing that the runner strides eight feet,

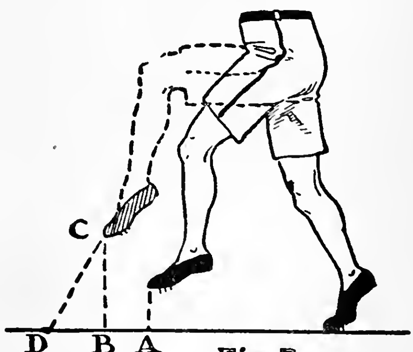


Fig 3

he would make 38 strides in running 100 yards, and if he gained an inch and a quarter on every stride, he would gain about four feet in going 100 yards. This is plenty to win or lose.

The Knees. In Fig. 3 we see the runner's leg from the hip down. If the knee is lifted to the position shown by the full line, the toe is over the point "A." But if the knee is lifted until the upper leg is horizontal, the toe is over the point "B." In this way the stride is lengthened by getting the full length of the upper leg into it. The toe should point downward, as shown at "C," and in coming down to the ground should follow the line "C–D." Practice these motions while standing still, raising the knees alternately as high as the waist and taking a long step forward. Of course the heel should never touch the ground.

The *arms* should not be doubled up to the chest. A runner is working with his legs and he only wastes his strength by cramping his arms up until they ache. The arms should hang full length. They should swing straight forward and back and not across the body. If swung in this way they help balance the body and also help to lengthen the stride. I have tried the experiment of tying the left arm of a runner behind his back and allowing him to swing his right arm. When he ran in this condition, in a place where his footprints could be seen, every stride made by the left leg would be six inches longer than the ones made by the right leg.

The Hands Most runners use grips, so that their hands have something to clench on during a spurt. This is of doubtful benefit. If grips are wanted, however, corncobs make the very best.

The *breath* in practice should be taken through the nose, as there is less danger of making the throat dry and sore. In a short race the breathing will take care of itself. In a long race breathe deeply in starting to get all parts of the lungs acting.

The *trousers* should be short, so as not to bind and interfere with knee action.

The *shoes* should be light and, if possible, should have short spikes in the soles to prevent slipping.

Last. Do not jump up and down. You are not trying to jump fences, but to cover distance. Therefore the top of your head should move along in a straight line and not in a wavy line.

Keep your eyes on the top of a fence as you run along beside it to see that your eye travels in a straight line parallel with the top of the fence.

Pull on your feet. That is, as long as a foot is on the ground keep pulling on it as though it were an oar. You can best accom-

plish this by practising trying to pick up the pebbles with your feet and throwing them behind you.

Practice with moderation at first. Pain in the chest, arms, and shoulders shows that you are cramping these muscles. Keep them relaxed. Aching in the muscles in front of the upper legs is a good sign, showing that you are lifting your knees more than usual. Aching in the calves is a good sign, showing that you are running on your toes.

CHAPTER III

Signalling for Boys

SEVERAL boys who know a little about signals can mystify a whole community by the curious and rapid way in which they keep each other informed. Of course the telephone could be used, if there were one, but there might not be one. And anyway, it is a bother to telephone; the other fellow is sometimes not there when called or the line is busy. Also, anyone can telephone, but everyone cannot signal, and by signalling things can be done that even the telephone at its best could not do.

Suppose three chums lived in the country some distance apart, but in sight of each other, and wished each other to know when they were at home. Each could keep a "private signal" displayed when home. This could be a flag, and mean, "I am at home." Yachtsmen often fly such a private signal to show when they are on board their yachts. This "private signal" can be designed by the owner, and if a flag, could show his originality and taste. But above all, it must be designed so that it can be seen from a distance, that is, it must have the quality of visibility.

This quality of visibility must never be forgotten in any signalling arrangements. It depends upon a great many points. Some of these points are apparent, but all of them are not. Anyone knows that a signal station must be chosen so that it can be seen from the other signal stations, and so it can see them; also that the size of a flag or the strength of a light must bear some relation to the signal distance, a great distance requiring a large flag or a strong light. But everyone does not know that the background against which the signals will best be seen must be considered. At Guantanamo, Cuba, during the first part of the Spanish-American War, this requirement was illustrated in a striking manner. It was necessary for the American marines to signal from their entrenched position on a hill to a man-of-war. An attempt was made to wigwag from the protected position, but the signal could not be seen properly from the ship, and it was necessary for

the signalman ashore to stand on a ridge where he was outlined against the sky. But he was favorably outlined not only to the Navy signalmen afloat, but also to the Spanish sharpshooters in the brush, who fired at him continually while he signalled. However the signal was sent and received and the plucky sergeant was not hit.

Another point is that a light of a certain strength can be seen at a less distance if a colored glass is used than if a clear one is used. This is because a colored glass acts something like a strainer and only permits part of the light to pass through it. Also, any small figures or complicated designs, the parts of which are necessarily small, should be avoided on a flag for distance signalling. For example, the flag of Brazil is very handsome, but one must be close to it to see what it really looks like. This is also true of certain royal standards, banners which are the "private signals" of kings or queens, and which are flown over palaces when the royal masters or mistresses are within.

In this country many of our officials have special flags, which are really "private signals." When the President is on board a man-of-war, his flag, a blue one bearing the characteristic American eagle, is displayed at the main mast. The Secretary of the Navy has a blue flag bearing a white anchor and four white stars. Admiral Dewey's flag is like this, except that it has no anchor on it. A senior rear admiral's flag is blue with two white stars.

But a private signal does not have to be a flag. For night it could be a light or combination of colored lights. When the captain is absent from a man-of-war a white light is displayed from a high position on the main mast, or in the case of an admiral, three white lights in a vertical row. A ship having the guard duty displays, at night, a red light at the top of the mast or truck.

What are known as distant signals, or shapes, are employed in the merchant marines and navies of the world for daytime signalling at considerable distances. These consist of combinations of a square flag (any color), ball, cone with point up, cone point down, and cylinder. On men-of-war, in formation under way, cones are used to indicate to other ships what the engines are doing. This suggests that shapes could be used for a "private signal."

This subject of a "private signal" has not been mentioned at such length because it is of first importance, but because there

are interesting things about it, and anything said about it serves equally well as a start in describing signalling in general. It is really signalling in general that is to be written about here, and suggestions will be given, with some actual examples, so that by reading this article boys can actually signal.

Signalling is intensely interesting to those engaged in that work aboard ship, and the signalmen and quartermasters are men of bright eyes and quick minds. Like many other things, it is both a business and a sport; and it is perfectly true to say that it is sport even when business. Signal hoist drills in the Navy are competitive, and the keenest interest is taken in them.

A society or group of boys, or a troop of Boy Scouts, could use signals among themselves, and the meanings of the various signals could be kept secret from boys not in their society. At schools, summer houses, on yachts or boats, and particularly at summer camps, signals could be used not only for fun, but in maintaining the safety and routine of the camp. To think of a few of the possible uses, one can turn to the Navy, or Army, or to the Indians, and in the paths of peace, to the railroads, shipping, Weather Bureau, and many other users of signals.

How very applicable to a boys' camp would be the signal (a blue flag with a white cross) used in the Navy for a General Recall. It means, "All boats return immediately." As each boat is numbered, any one boat can be recalled by hoisting its number over the General Recall.

There is also another very important signal used in the Navy called the Cornet. This red and white quartered flag means "All officers and men return aboard immediately." A gun may be fired to call attention to it. On board a man-of-war, when the crew is at meals, a red pennant is flown from the yardarm. A blue pennant, flying from the yardarm, indicates the ship of the senior or ranking officer present, if below the rank of commodore. Commodores and admirals, as already mentioned, have special pennants or flags. These cases just given no more cover the great question of signalling in the Navy than the points mentioned in this article can cover all the possibilities of signalling for boys. Individual thought and ingenuity will uncover uses and methods.

Suppose three boys, Allen, Butler, and Charles, wish to take up signalling among themselves. Each chooses the location of his

signal station where he can see the others, and be seen. A mast should be erected. It could be on the house, and the signals made from a window, or it could be on the ground or on the barn. A mast might not be needed; some tall tree, pole, or building might serve. A flagpole already in place would be just the thing. It would be a good thing to have a yard or cross-piece near the top of the mast. At the masthead and at each yardarm a small block, or pulley should be secured. Through these blocks the signal halyards should be led, preferably of pliable woven line. These are "ropes" for hoisting the signals. On one end of the halyards a ring should be secured, on the other end a snap hook. The flag, shape, or lantern should have a snap hook at the upper part of it, and a ring at the lower part. This arrangement provides for easily "bending on" the signals for hoisting, and is the method followed in the Navy. At the base of the mast should be three cleats for securing the halyards.

Each signalman should provide himself with three flags or three shapes and three lanterns. The flag should be of cheese-cloth or bunting, of rectangular or square shape, and colored red, yellow, and blue, respectively. Notice that their sequence is red, yellow, blue, one, two, three, like red, white, and blue. This is a little aid to the memory. The ring and snap hook that a flag is to carry should be secured to the ends of a piece of halyard line, which by a piece of "tabling" of duck or light canvas is stitched to the inner edge of the flag. This piece of line should be longer than the flag is wide, to provide for spacing the flags when hoisted.

The shapes should be made of light canvas or duck, on wooden or wire frames, and painted as the background requires. They can and should be collapsible for convenience in stowing away. For example, the ball needs only a ring at the middle, the cone needs only a ring at the bottom, and the cylinder, a ring at each end. These shapes are ball, cone (point up), and cylinder, one, two, three, respectively, and in alphabetical order.

The lanterns could be ordinary oil lanterns, red, white, and green, respectively. These colors can be made by colored glasses, preferably, or by wrapping colored bunting around the clear glass. Notice that the lanterns follow the regular order easy to remember, like red, white and blue, that is, red, white, green, one, two, three, respectively.

Each signalman should have a telescope or field glass if the distances are to be great. Each one should have a record book, and record in it each signal sent or received, with the exact time and date, from whom sent, and by whom received.

One boy can run a signal station, but if there are two or more it can afford work for all and the signalling will be faster. Thus, one could bend on signals and hoist, and one could read the others' signals and record.

The boys are now prepared to signal by any of the three methods, flags, shapes, or lanterns. Shapes can be seen from any point of the compass, regardless of the direction of the wind, which is not true of flags. They are a little harder to make and a little more expensive. As flags and shapes are both methods of day signalling, it is not necessary to have both outfits.

In any outfit there are three elements, and they can be combined in fifteen different and distinct ways, thus making fifteen signals or hoists. A meaning is given to each hoist or signal.

In signalling, one reads a signal hoist from the top. For example, 123 is (with flags) red flag uppermost, then yellow, then blue. Or with shapes, 123 would be ball, cone, cylinder. With lanterns, it would be red, white, green.

Now to be able actually to transmit signals and receive prompt replies a lookout must be kept, at least at certain times agreed upon. If man-of-war routine is followed by our signalmen regarding the "colors," or American flag, they will hoist it at eight each morning. This would be a good time to exchange signals. In a camp, or boat, one boy could be detailed as lookout signalman, and a continuous watch kept; or a gun could be fired to call attention to a signal, and no lookout would be required.

For the transmission of signals there must be continuous understanding between all concerned, and the rules of signalling are based upon that requirement.

There must be a way "to call" another station—to say, "I am calling you, Allen." There must be a way of saying, "I see your call" or "I see your signal." This is called "answering" or "acknowledging." Generally a pennant is used for this purpose, but it can be done another way and a pennant saved.

There must be a way of making "interrogatory," which means, "I can't see well" or "I don't understand." There must be a

way to say "I have finished signalling," and a way to "answer" that. The rules given here are made hard and fast simply in order to be definite. There are numerous other ways of doing these things. For convenience, some of what has already been said is shown in Table First. Table Second shows the meanings assigned the signals or hoists. When reading a signal, or recording or speaking about it, say "one, two, three," or "two one," or whatever it may be. The Roman numerals are reference numbers whose use will be indicated later.

B wishes to reply "yes" to A. A, having invited B, keeps a good lookout for a "call" from B. B now calls A, and A answers, and signals V. Affirmative (or yes) is sent by B to A in the manner just described.

The illustration given has shown the "private signals," how to "call," how to "answer" (or acknowledge), both when the call or hoist is displayed and when hauled down, and how to show that the signal is finished. The "private signal," or "call," it will be noticed, means any one of several things at different times, according to circumstances, and that without chance of mistake. The receiver should display signal IV (Interrogatory) if he cannot see or understand the signal made. The sender acknowledges this by hauling down, whereupon the receiver hauls down "Interrogatory." "Interrogatory" also makes a question of another signal made after it. For example: IV—VIII—X means "Will you come over for tennis?"

The "Affirmative" means "Yes," or "Duty completed," or "I am ready." It means "yes" unless other circumstances indicate clearly one of the other meanings. "Negative" means "No," or preceeding another signal puts it in the negative sense. For example: VI—VIII—X means "Do not come over for tennis."

Signal XIII (Hour) is a special one for indicating the hour of day. It means that the one hoist next following is to be given its Roman numeral value and mean that hour of the day. For example: XIII—X means "Ten A. M.," and XIII—XIII—X means "Ten P. M."

The "General Call" (XV) calls all the other signal stations. They answer in the regular way, that is, by dipping their calls. Now an example will be given of a longer signal. Suppose Allen wished to signal all the others to be at the Country Club the next

morning at ten to play tennis. The required hoists would be XV—XIV—IX—XIII—X—X.

The use of signal XIII, giving another (or secondary) meaning to the first twelve hoists, suggests that third meanings could be given to all hoists if desired.

For example, signal XIV could be assigned the meaning, "Give the third meaning to the one signal next following." Then the third meaning assigned the first seven hoists could be the days of the week. To VIII, "Rally at the regular meeting place"; to IX, "I will join you"; to X, "Ask the family," and so on. This suggestion is merely to show how more signals can be made with this same apparatus without adding to it. Of course, by adding even one more element, such as one red flag, one ball, or one red lantern, the number of original, primary signals can be greatly increased. The important thing for young signalmen to do is to study the possibilities of their apparatus, and their codes can be made very extensive and, therefore, very useful.

The example just given illustrates the following general rules:

To call one signal station, hoist the "call" of the station to be signaled.

To call all signal stations, hoist the "General Call."

To answer a call or a hoist, the station called dips its call. Should it be called when its "private signal" (own call) is not displayed, it should, in order to answer, hoist its own call, and then dip it. The fact that the sender has hauled down is acknowledged (or answered) by the receiver hoisting his call all the way up.

To indicate "End of Signal" the sender hoists his call all the way up.

To answer "End of Signal" the receiver dips his call, which is the regular way for answering, but as the end has been indicated, he then hoists his call all the way up.

Nothing has been said about wireless telegraphy, a most important and efficient form of signalling, as it is a subject in itself. Nothing has been said about sound signalling, by whistle, bell, or gun, nor about semaphore signalling, night or day, nor about signalling with rockets and colored stars projected like Roman candles, nor about flashing lights, searchlight, or blinker light, using mechanical shutter or electric key, and almost nothing about the wigwag. Perhaps another time these will be told about, with adaptations of them suggested for the use of boys.

The subject of signalling is a vast and interesting one. None of us can know all about it, but most of us could learn something about it. It would be fun and it would be useful. In some time of public calamity, like flood or fire or wreck, a little knowledge of signalling might enable some boy to render a great public service, to save many lives.

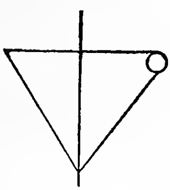
TABLE FIRST.

Element No.	Flags.	Shapes.	Lanterns.
1	Red	Ball	Red
2	Yellow	Cone	White
3	Blue	Cylinder	Green

TABLE SECOND.

Signal Reference No.	Hoist.	Meaning.
I.	1	Allen's call. Also his private signal.
II.	2	Butler's call. Also his private signal.
III.	3	Charles' call. Also his private signal.
IV.	12	Interrogatory.
V.	13	Affirmative.
VI.	21	Negative.
VII.	23	Cancel: Once, Last Hoist; Twice, Last Message.
VIII.	31	Rally here.
IX.	32	Tomorrow.
X.	123	Tennis.
XI.	132	Baseball.
XII.	213	Football.
XIII.	231	Hour: Once, A. M.; Twice, P. M.
XIV.	312	Rally at the regular meeting place.
XV.	321	General call.

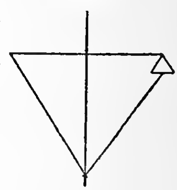
Allen

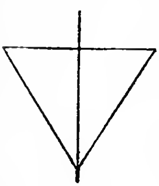


An example of the way of signalling will now be given, using shapes. Exactly the same rules are followed using the other methods. Initials will be used in referring to the boys.

Both are home; their "private signals" are displayed. That is, each is flying his own "call."

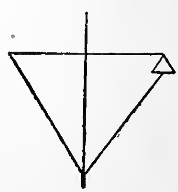
Butler



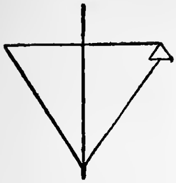


Now suppose that A wishes to ask B to come over.

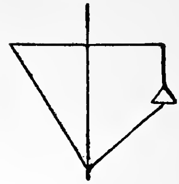
A hauls down his call.

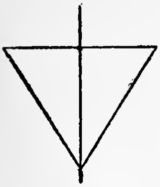


Allen **Butler**

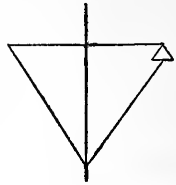


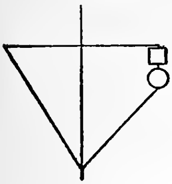
A then hoists B's call. B "answers" by dipping his call, that is, by hauling it part way down, but keeping it displayed. This is the regular way of "answering" any call or hoist.



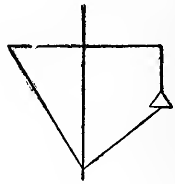


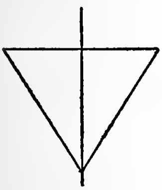
A sees that B answers him, and hauls down B's call. B "answers" by hoisting his own call, showing he has seen A haul down. This is the regular way of "answering" the sender's "haul down."



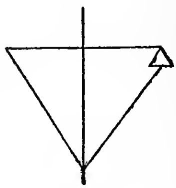


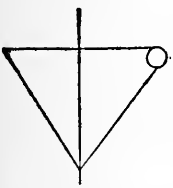
A hoists signal 31 (VIII—Rally here), and B answers by dipping his call.



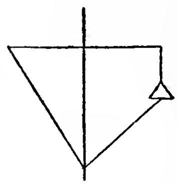


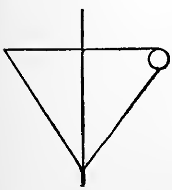
A sees that B answers, and hauls down signal VIII and B answers that by hoisting his call.



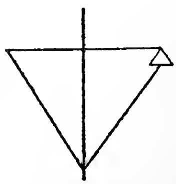


A has finished, and shows it by hoisting his own call. B answers by dipping his call.





B then hoisting it again, A thus sees that B answers. This finishes that signalling, and to signal any more, one or the other must make a "call."



PART III

ROPEWORK EVERY BOY SHOULD KNOW

CHAPTER I

Simple and Useful Knots

The simplest knot that is made is the overhand knot (Fig. 1). It is very useful, and forms a part of many other knots. To make it, the standing part of the rope—that is, the main part in opposition to the end—is held in the left hand, and the end of the

FIG. 1.—OVERHAND KNOT.

rope is passed back over it (whence its name) and put through the loop thus formed. It is used at the end of a rope to prevent the strands unlaying, and sometimes in the middle of a rope as a stopper knot. If the end of the rope is passed through the "bight"

FIG. 2.—FOURFOLD OVERHAND KNOT, LOOSE AND TAUT.

or loop two, three, or more times before hauling it taut, the double, treble, or fourfold knot, "A" (Fig. 2), is obtained. This is a larger knot than Fig. 1, and is often used on the thongs of whips, being then termed a blood knot. "B" (Fig. 2) shows the knot hauled taut.

Figure 1 also goes by the name of the Staffordshire knot, as it forms the insignia of the county. A Flemish or figure-of-eight knot is shown by Fig. 3. To make it, pass the end of the rope back, over, and round the standing part, and up through the first bight. The Flemish knot is used for much the same purposes as the preceding knots, but is rather more ornamental.

The bight of a rope is the loop formed when a rope is bent back on itself, in contradistinction to the ends.

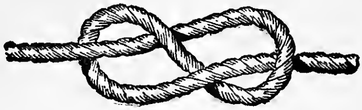


FIG. 3.—FIGURE-OF-EIGHT KNOT.

The conditions under which the ends of two pieces of cordage have to be joined together are various, and several methods are brought into requisition; but it is always of considerable importance that the most suitable knot be employed in each case. The value of some knots consists in the rapidity with which they can be made, of others in the readiness with which they can be undone; but it is an essential that the knot holds firmly and does not slip when once hauled taut.

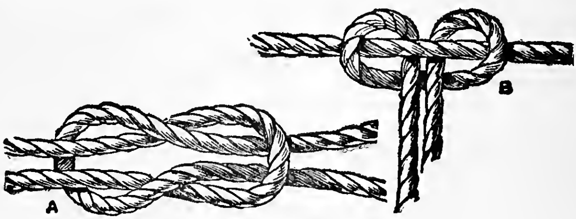


FIG. 4.—SAILOR'S KNOTS OR REEF KNOTS.

The commonest knot for joining the ends of two ropes, and probably the knot that is most often made, is the sailor's true, or reef knot (Figs. 4 and 5). When correctly made it is as perfect as a knot can be. It can be made and undone with equal rapidity, and is very secure when taut. Its one disadvantage is that it will not answer when made with ropes of different sizes, as it then slips and comes adrift, but where the two pieces of cordage are

of the same size it is most secure and reliable, the strain being equally distributed on every part. It requires a little practice to make it properly. To do this, take an end in each hand and lay one over the other, the right end being undermost; bring the left-

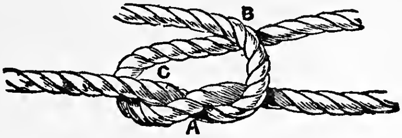


FIG. 5.—REEF KNOT, HALF-MADE.

hand end under the standing part of the right end, as shown at "A" (Fig. 5), and over the end at "B," round it, and up through the bight at "C." The key to the knot is the putting of the right end under the left when the two ends are crossed at the beginning of the

FIG. 6.—GRANNY OR LUBBER'S KNOT.

knot, as the left-hand end then comes naturally first over and then round the other rope, and the ends lie parallel with the standing parts, as at "A" (Fig. 4).

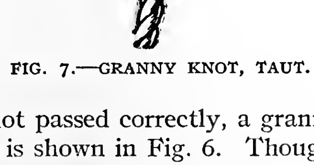


FIG. 7.—GRANNY KNOT, TAUT.

If the ends are not passed correctly, a granny, lubber's, or calf knot results. This is shown in Fig. 6. Though at first sight this seems to be a good knot, yet it is not so in reality, and when any strain comes upon it it slips and becomes useless. Figure 7 is a

granny knot, as it appears when hauled upon. It is considered a very lubberly thing to make a granny knot, and readers should practise until they can make a true knot rapidly and with certainty in any position.

The sailor's knot is invariably used for reefing sails, the ease with which it can be undone making it very valuable for this purpose. It is only necessary to take hold of the two parts on each side just outside the knot and bring the hands together, and the loops slip over one another, as in Fig. 4, and the knot can be opened at once.

This knot has a curious peculiarity which is not generally known. If the end of one of the ropes is taken in one hand and the standing part of the same rope in the other, and both are hauled until the rope is straight, the knot becomes dislocated, so to speak, and the rope not hauled upon forms a hitch, "B" (Fig. 4), round the other part. This property was the secret of Hermann's celebrated trick, "the knotted handkerchiefs." After the handkerchiefs, knotted together at the corners, were returned to him by the audience, under pretence of tightening the knots still more, he treated each knot as has been described. The knots seemed firm, but really were loosened so that a touch with his wand separated them easily.

The common bow or rosette knot is a modification of the sailor's knot. The first part of the process of making it is the same, but instead of passing one end singly over and under the other, as in the sailor's knot, both ends are bent back on themselves, and the double parts worked as before. Care must be taken to pass these doubled ends exactly as those described in the sailor's knot, or a granny bow will result. Some persons' shoes always come untied, the reason being that they are tied with granny instead of true bows.

Another way of joining the ends of two pieces of cordage is shown in Fig. 8. This is merely an overhand knot, made with two ropes instead of one. Sometimes it is called an openhand knot. It can be made very quickly, and there is no fear of its slipping, but if there is much strain put upon it the rope is very apt to part at the knot, in consequence of the short "nip," or turn, that it makes just as it enters the knot.

Figure 9 shows the weaver's knot partly made, and Fig. 10 the

same knot completed, but not hauled taut. Weavers call this the "thumb knot," as it is made over the thumb of the left hand, and is used by them in joining their "ends" as they break. The rapidity with which they make the knot, snip off the ends, and set the loom going again is wonderful. Netters use this knot to join

FIG. 8.—OVERHAND ROSETTE KNOT OR BOW.

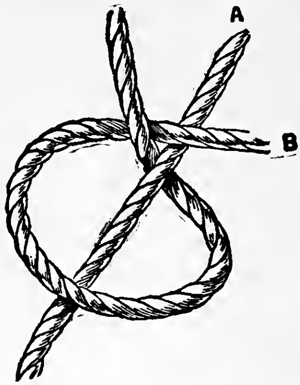


FIG. 9.—WEAVER'S KNOT, HALF-MADE.

their twine, and it also forms the mesh of the netting itself, though, of course, it is then made in a very different way. In making the weaver's knot, the two ends to be joined are crossed in the same way as in the sailor's knot, placing the right end under, and holding them with the thumb and finger of the left hand at

FIG. 10.—WEAVER'S KNOT, CLOSED.

the place where they cross. The standing part of the right-hand rope is then brought back over the thumb and between the two ends, as shown in Fig. 9. The end "A" is then bent down over it, and held with the left thumb, while the knot is completed by hauling on "B."

An excellent way of joining two ropes is illustrated by Fig. 11. The ends are laid alongside one another, overlapping each sufficiently to give room for the knot to be made. The double parts are then grasped in each hand and an overhand knot is formed, which is made taut by hauling on both parts at once, as if the knot were single.

Though the above is the easiest way to make the knot, it is not available where the ropes are fast. In this case a simple knot is

FIG. 11.—OVERHAND KNOT JOINING TWO ROPES.

made on the end of one rope, but not drawn taut. The end of the other rope is passed through the bight of the first, and a second loop formed with it alongside the first. The knot is closed by drawing the two ropes as before. This is in every way an excellent knot, and very secure.

Figure 12 shows the ends of two ropes joined by means of a Flemish knot. It does not require much description, and is made after the manner of the knot last described.

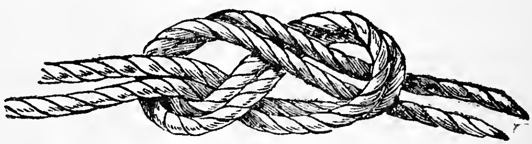


FIG. 12.—FLEMISH KNOT JOINING TWO ROPES.

The fisherman's knot (Fig. 13) derives its name from the fact that it is always used for joining silkworm gut for fishing purposes. In making it the strands are made to overlap one another, and an overhand knot is made with one end round the other strand. The strands are turned round, and another overhand knot made with the other end round the first strand. When the knot is tightened by hauling on the standing parts, one knot jams against the other and holds securely. The knot is improved by putting the ends twice through their respective loops, as at "A" (Fig. 2, p. 307).

The size of the knot is increased by this means, but it will stand a much heavier strain, so that it is advisable to do this whenever the size of the knot is not of paramount importance.

FIG. 13.—FISHERMAN'S KNOT.

The whipcord knot (Fig. 14) is used to fasten the lash to a whip. The lash "B" is laid across the ends of the thong "A," which are turned up over it. The lash is brought completely round the thong and through the loop it makes, which secures the ends of the thong

FIG. 14.—WHIPCORD KNOT.

firmly. If a silk lash is used, the short end is cut off, but if whipcord, the two ends are generally twisted together for a few inches, as at "B," and an overhand knot made with one end round the other, to secure them. The remaining part is left somewhat longer, and another overhand knot at the end prevents it from unravelling.

CHAPTER II

Eye Knots, Hitches, and Bends

One of the simplest eye knots is shown by Fig. 15, and is known as the "running" or "slip knot." A bight is first formed, and an overhand knot made with the ends round the standing part.

FIG. 15.—RUNNING KNOT.

FIG. 16.—FISHERMAN'S EYE KNOT.

The last named may be drawn through the knot, and the eye made to any size required. There is less chance of the knot coming undone if an overhand knot is made on the end "A." With this knot a sailor ties his neck-handkerchief.

Figure 16 is the "fisherman's eye knot." A bight is first made of sufficient length, and an overhand knot formed with the standing part round the other strand; the end is now passed round the standing part, and knotted as before. Thus there is a running knot, "A," with a check knot, "B," which, when hauled upon, jam tight against one another, and hold securely. This is one of the best knots for making an eye in fishing, as the strain is divided equally between the two knots.

A common way of making an eye on the end of a piece of cord is illustrated by Fig. 17. It is practically the same knot as Fig. 8 (p. 311), except that only one rope is used. The end is brought

FIG. 17.—OPENHAND EYE KNOT.

FIG. 18.—FLEMISH EYE KNOT.

back along the rope to form the eye, and an overhand knot made with the two parts. This knot, from being so easily made, is often used, but it lacks strength, like the openhand knot (Fig. 8), and should not be used where it is required to bear much strain. It will have been noticed how very often openhand knots form the component parts of other knots.

Figure 18 is an eye made with a "Flemish" knot. It is worked just the same as a single Flemish knot (Fig. 12, p. 312), the only difference being that two parts are used instead of one. It is stronger, but clumsier, than the one just described, and is not much used.

The "crabber's knot" (Fig. 19) is a curious and not very well-

known knot, but it is unlikely to part when strained. To make it, bring the end back to form a loop, taking it first under and then over the standing part, up through the main loop, over the standing part again, and up through its own bight. Before the turns are hauled into their places, the knot will slip on the part "A," as in an ordinary slip knot; but if the part "B" is hauled upon, the strand "A," which passes through the center of the knot, rises, and the coil which goes round it jams, making the knot secure; so that it may be used as a running knot or otherwise, as desired. This is also called a running knot with crossed ends.

FIG. 19.—CRABBER'S KNOT.

The "bowline knot" (Fig. 20) cannot slip, and is therefore always used for slinging a man for the purpose of doing some particular piece of work; the workman sits in the sling. The end is first laid back over the standing part, so as to form a loop; the end is then passed up through the loop, round the back of the standing part, and down through the loop again. Hauling on the end and the standing part makes the knot taut.

A modification of this knot, called a "Bowline on a Bight," is shown by Fig. 21. The loop is made as in the previous knot, only with the two parts of a doubled rope; the bight is then passed up through the loop, opened, and turned backward over the rest of the knot, when it appears as illustrated. To untie it, draw the bight of the rope up until it is slack enough, and bring the whole of the other parts of the knot up through it, when it will readily come adrift. If the standing parts of the rope are held fast, it puzzles the uninitiated to undo it.

A "Running Bowline" has the knot made on the end after it has been passed round the standing part, thus forming a loop through which the main rope will run. Two ropes may be joined together by making a bowline in the end of one of them, and putting the end of the other through the bight, and forming with it another bowline on its own part. This is often used to join hawsers together.

FIG. 20.—BOWLINE KNOT.

FIG. 21.—RUNNING BOWLINE ON BIGHT.

Figure 22 shows a method of making a rope fast to a post or pillar. The rope is doubled and passed round the post, and the ends put through the loop. For greater security, the ends may be passed round the standing part and through the bight thus formed, as in Fig. 23; or, instead of passing the cords through the bight, a loop may be formed by doubling the ends, and this loop put through the bight, thus forming a slippery hitch. This knot has the advantage of being more readily undone than the other one, as it is necessary merely to pull at the ends, and the rope is released at once. The ends may also be secured by making a Flemish knot on them, instead of an overhand knot.

The remainder of this chapter will discuss a different class of fastenings. It is not easy to state, however, where knots end and

bends and hitches begin; indeed, a tie that, in certain circumstances and made a particular way, is called a "knot," differently

FIG. 22

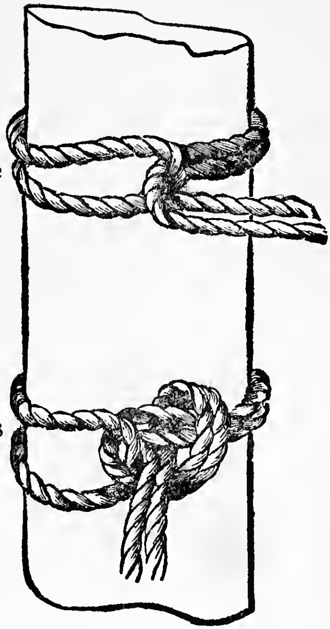


FIG. 23

FIGS. 22, 23.—RUNNING KNOT WITH TWO ENDS, LOOSE AND FASTENED.

constructed, and under other conditions, is called a "bend" or "hitch," though the result is the same in both cases. As an illus-

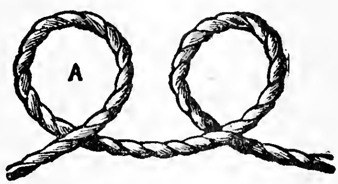


FIG. 24.—TWO HALF HITCHES.

tration, take two half hitches (Fig. 24), which, if made in another way round a pole, are called a "builder's knot." If readers will

analyse the knots illustrated throughout this book they will find several other similar instances. "A" (Fig. 24) is a single hitch, being merely a loop formed in a rope. This is readily done by holding the rope in the left hand, and giving it a twist with the right; the loop then forms itself, as it were. When a tightly laid piece of cordage is twisted, these loops are apt to rise and form "kinks," which are very objectionable, as the cord is sure to part at the kink when a strain is put on it. It is still worse in the case of wire, which breaks readily when kinked. Tight, hard cordage should always be well stretched before it is used, to avoid kinking.

Two half hitches (Fig. 24) are a useful knot for a variety of purposes, as they are quickly made, and will not slip, no matter what strain is put upon them—indeed, the more they are hauled upon, the faster they hold. They are the best means of making a

FIG. 25.—BUILDER'S KNOT, OR CLOVE HITCH.

rope fast to a hook. First one hitch is slipped on, and then the other on the top of it, and the rope is fast in less than two seconds. This knot is used by surgeons in reducing a dislocation of the thumb joint.

Figure 25 is the builder's knot, merely two half hitches, but, as it is used in places where the hitches cannot be passed over the ends of the timber, it is made by holding one end in the left hand, passing the rope round the pole, under the end, round the pole again, above the first part, and under its own part; from its non-liability to slip laterally this knot is always used to fasten one pole to another in fitting up scaffolding, from which circumstance it has acquired its name. If, instead of beginning the knot as in Fig. 25, the end is passed, after it has gone round the pole, two or three times round the other part, as in Fig. 2 (p. 307), the remainder

of the knot is rather more easily made, as it holds itself taut, and will not slip while the end is put round to complete the fastening.

A "builder's double knot" is made in the same way, except that the end goes round again, as before, and underneath its own part, so making it much stronger. When a builder's knot is made on a rope for the purpose of securing a small line to a stout rope, it is called a "clove hitch."

The "timber hitch" (Fig. 26) is a rough and ready way of securing a piece of timber or anything similar; it is made by bringing the end of a rope round the timber, then round the standing part, and then, taking two or more turns, round its own part. The

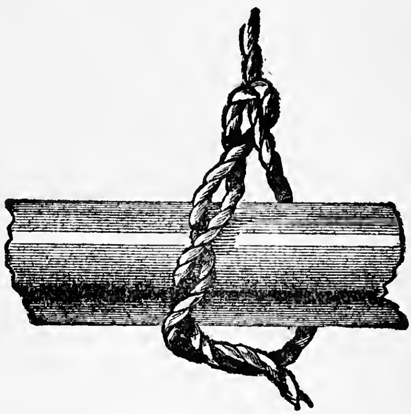


FIG. 26.—TIMBER HITCH.

pressure of the coils one over the other holds the timber securely, and the more it is hauled on, the tighter it holds. It can be cast off readily.

Figure 27 is the "killick hitch," a modification of the timber hitch, used for fastening a stone to the end of a rope. After making a timber hitch and hauling it taut, a single hitch is made, and slipped over the end of the stone alongside of it. Some of the best fishing grounds are on rocky coasts where an anchor would not hold; and if it did, there might be considerable risk of losing it altogether, from its jamming in the crevices of a rock. In these places a killick, or large stone, slung as shown in Fig. 27, is used,

which holds the boat by its own weight, without any risk of getting fast to the ground.

The "magnus hitch" (Fig. 28) is a method of securing a rope to a spar, as there is but little tendency to slip endways along the

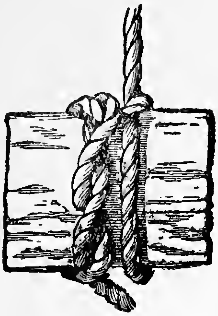


FIG. 27.—KILLICK HITCH.

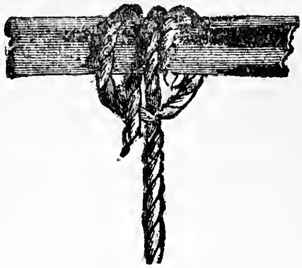


FIG. 28.—MAGNUS HITCH.

spar. In making it, take the end of the rope twice round the spar, in front of the standing part, round the spar again, and then through the last bight.

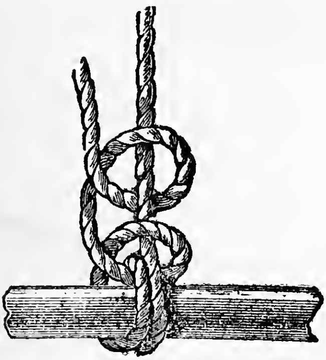


FIG. 29.—FISHERMAN'S BEND.

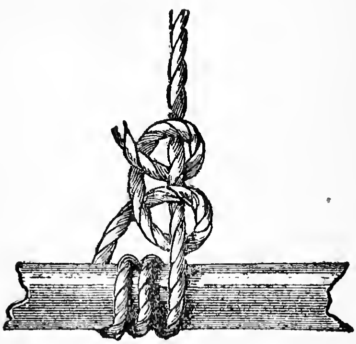


FIG. 30.—ROLLING HITCH.

The "fisherman's bend" (Fig. 29) consists of two round turns round a spar, and a half hitch round the standing part, and through the turns on the spar, and another half hitch above it, round the standing part. It is used for bending studdingsail hal-

liards to the yard, and, in yachts, for bending on the gaff topsail halliards.

A "rolling hitch" (Fig. 30) is made by taking three round turns round a spar, and then making two half hitches round the standing part of the rope, and hauling taut.

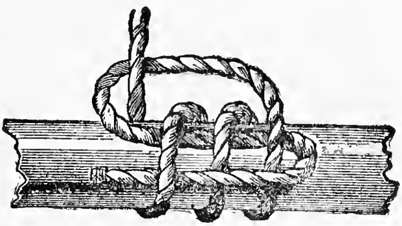


FIG. 31.—TOPSAIL HALLIARD BEND.

FIG. 32.—RACKING HITCH.

The "topsail halliard bend" (Fig. 31) is used chiefly on board yachts, and is made by bringing the rope twice round the spar, back round the standing part, under all the turns, over two turns, and under the last. This hitch is shown open for the sake of clearness, but in practice it is usual to jam the coils close together, and haul them all taut.

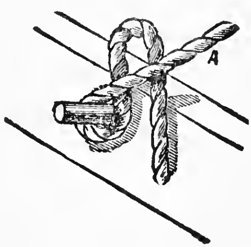


FIG. 33.—SLIPPERY HITCH.

Figure 32 is a "racking hitch," for hitching a rope on to the hook of a block. Two bights are made in a rope, these are turned over from the operator two or three times, and the two loops are put on to the hook. This is sometimes called a "cat's paw."

The value of the "slippery hitch" (Fig. 33) consists in the readiness with which it can be cast off in case of emergency; at the same time, it holds securely while there is a strain on the rope "A." If the mainsheet of small boats is made fast at all, always a more or less risky proceeding, a slippery hitch should always be used as a start. A sharp pull at the end of the rope lets the sheet go at once.

For the "carrick bend" (Fig. 34) lay the end of a rope over the standing part to form a loop; put the end of another rope under the bight over the standing part at "A," under the end at "B," over the rope again at "C," under its own part, and over the rope "B," and haul taut. The parts "A" and "B" form the first loop made.

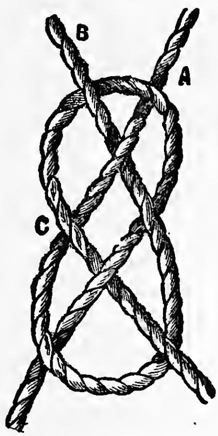


FIG. 34.—CARRICK BEND.

This bend generally is used for binding hawsers together, to increase their length for warping or towing. It can be undone readily without the aid of a pricker or marlinespike, which would have to be used for many knots after they had been in the water. As in the sailor's knot, it is only necessary to grasp the ropes just outside the knot, and push the loops inward, and the knot comes adrift at once.

Figure 35 shows the clew of a sail, and the method of bending the sheet on to it. This is termed a "sheet bend." The sheet is not, as many suppose, a part of the sail, but is a rope used in setting a sail, to keep the clew or lower corner of the sail down to its

place. In making a sheet bend, the end is passed up through the clew, round the back of it, under its own part, and over the clew again. The end is generally stopped to the standing part with rope yarn or other small stuff. The knot thus formed is exactly the same as the weaver's knot (Fig. 10, p. 311). Figure 36 shows a method of giving additional security to this knot. The end is

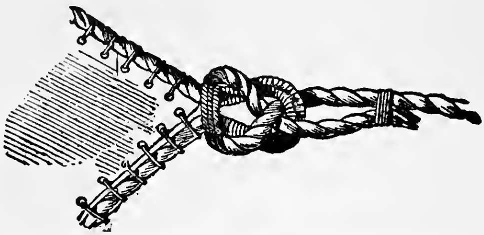


FIG. 35.—BENDING SHEET TO CLEW OF SAIL.

passed twice round the back of the loop before putting it under its own part. This knot is very much used by fishermen in bending a line on to a loop of gut.

Another and somewhat more complicated method of bending a rope on to a loop is illustrated by Fig. 37. "B" is the standing part, and "A" the end of the rope to be bent on a loop already

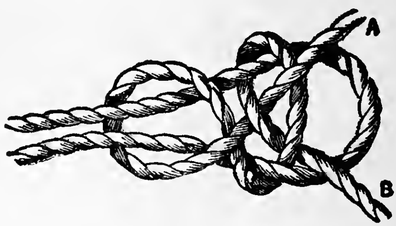


FIG. 36.—MORE SECURE SHEET BEND. FIG. 37.—BENDING ROPE TO LOOP.

formed. Pass the end down through the loop, round over its own part, and through the loop, round the back of it, and through its own bight. When hauled taut, this holds more securely than either of the other methods, but, on the other hand, takes longer to make.

The "Blackwall hitch" (Fig. 38) is a ready way of securing a rope temporarily to a hook. The method of making it is evident from

the illustration. As the standing part when hauled upon jams the end against the back of the hook, it holds much more firmly than would be supposed at first sight.

The "midshipman's hitch" (Fig. 39) is an old-fashioned hitch, used for attaching a tail-block to a rope. A round turn is first made over the standing part, and the end is brought up, passed twice round above the first hitch, and then passed out underneath its own part.

FIG. 38.—BLACKWALL HITCH.

FIG. 39.—MIDSHIPMAN'S HITCH.

The "marlinespike hitch" (Fig. 40) is used for getting a purchase on the seizing stuff when serving a rope, so as to leave the turns taut. Make a bight in the seizing stuff, and bring it back over the standing part; pass the marlinespike under the standing part, and over the sides of the bight. This is practically identical with the running knot (Fig. 15, p. 314).

Figure 41 is a "regulating lashing," used when the tension of a rope requires altering from time to time. Tent ropes are secured this way, as they require easing in wet weather, and tightening in

dry. For this purpose, the piece of wood "A" is slipped up or down the cord, the friction of the cord against the sides of the hole fixing it sufficiently.


FIG. 40.—MARLINESPIKE HITCH.

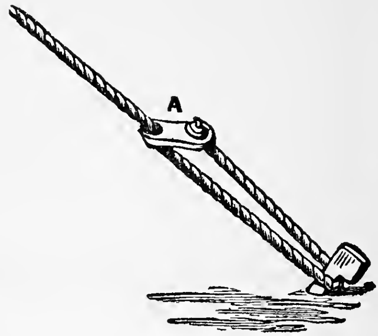


FIG. 41.—REGULATING LASHING.

The "stationer's knot" (Fig. 42) is handy for tying up a parcel, as it can be made rapidly, and undone with ease. Make a running noose at the end of a piece of twine, and bring it to the center of

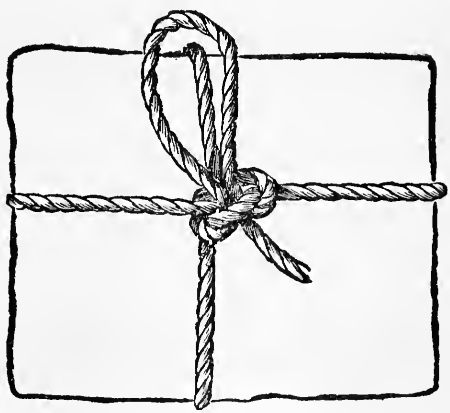


FIG. 42.—STATIONER'S KNOT.

the parcel; take the twine round the parcel again at right angles, round the noose, and, making a bight, slip it under, as illustrated. A pull at the end releases the knot instantly, as can be proved by experiment.

CHAPTER III

Ties and Lashings

A "WEDDING KNOT" or tie, used for fastening together the eyes at the ends of two ropes, is shown by Fig. 43. It is made by passing rope-yarn or marline through the eyes backward and forward

FIG. 43.—WEDDING KNOT.

until strong enough, and then is fastened by taking several turns round the middle and fastening the ends with a reef knot. This forms a sort of hinge between the ropes.

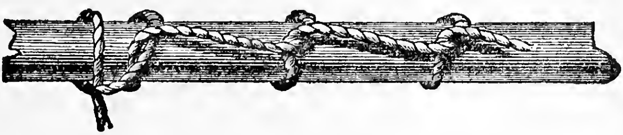


FIG. 44.—CHAIN KNOT LASHED TO SPAR.

The "chain knot," for lashing to a spar, is illustrated by Fig. 44; a clove-hitch is first formed round the spar, and as many single hitches as required are then made. It may be finished off with any

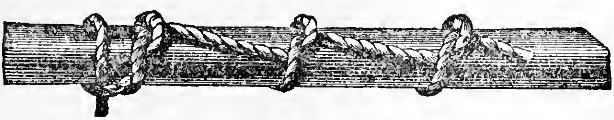


FIG. 45.—IMPROVED CHAIN KNOT.

secure knot. Figure 45 shows another and better way of making the chain knot. An overhand knot is formed at each turn, and, consequently, it is much more secure than Fig. 44. This is used for

bending yachts' sails to the gaff. As each turn forms a knot if the cord parts, the remainder holds firm, and does not necessarily come adrift, as it would be almost sure to do if it fastened as in Fig. 44.

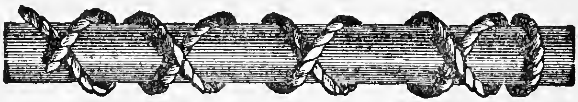


FIG. 46.—CROSS LASHING.

Figure 46 is a "cross lashing," employed when a lever is used to a rope. After several turns round the rope, the lashing is crossed round the lever and fastened with a reef knot. All these lashings

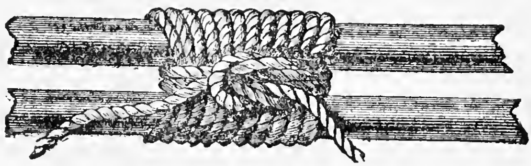


FIG. 47.—NECKLACE TIE.

are used when several men are required to haul on large ropes at the same time.

For the "necklace tie" (Fig. 47) several turns are taken round the spar to be joined, then two turns round the lashings, and it is

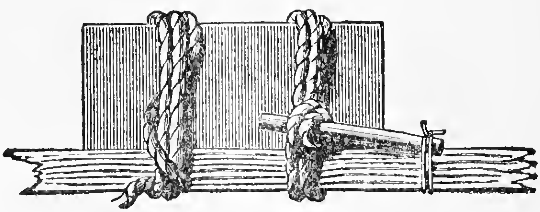


FIG. 48.—PACKING KNOT.

secured with a reef knot. When this is used as a lashing for shear-legs, the crossing of the two legs puts a strain on the knot, and effectually secures it. For this purpose it is called a Portuguese knot.

Figure 48 shows a "packing knot," used for securing large pieces of timber together. It is used near stone quarries for holding the blocks of stone on to the carriages by which they are moved. Figure 48 represents a block of granite secured to a trolley with packing knots. Two or three turns are made somewhat loosely with cordage round the block and its carriage; a stout piece of wood is then inserted under the coils, and twisted round until all the slack is taken out and the cordage is taut. The end of the lever is then secured with twine to the side of the carriage, as shown in the right side of the figure. The other lashing is supposed to be all ready for tautening up.

It is often necessary to lash two things together without showing an external knot, which would spoil the smoothness and neatness of the work—as, for instance, in whipping the two parts of a

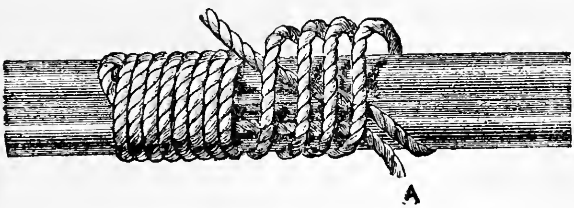


FIG. 49.—FINISHING OFF WHIPPING.

broken fishing-rod together. Figure 49 shows a common method of finishing off whipping without showing a knot. Lay one end forward, as at "A," then pass the other end round and round a sufficient number of times, hauling taut each time; three or four loose turns are now made, and the end passed under them backward; these are worked down into their places, and when the ends are hauled taut and cut off the job is completed. The end "A" need not come so far as shown in Fig. 49, but may be hidden under the coils.

Figure 50 is another method of accomplishing the purpose. Instead of a single end, as in the last case, a bight of the seizing stuff is laid along the part to be whipped, and the turns passed over it; when these are completed the end is passed through the bight, as at "A." The end "B" is now hauled upon to bring the bight and the end of the rope snug under the coils. There are now

two loops interlacing at the center of the work, and these cannot come undone. When the ends "A" and "B" are cut off close to the turns, the whole is fair and smooth.

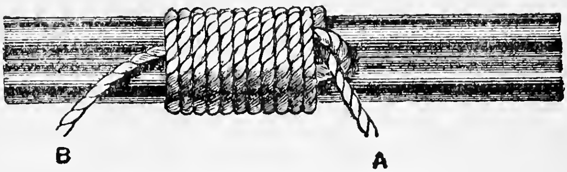


FIG. 50.—FINISHING OFF WHIPPING.

"Nippering," or "packing," is shown in Fig. 51. This is a method of securing two ropes together with cross turns; these are hauled taut, jambing the ropes together, and are further secured by round turns over all, with a reef knot at the ends.

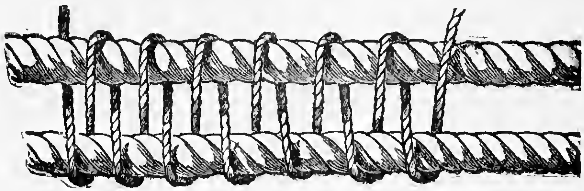


FIG. 51.—NIPPERING.

The "west country whipping" (Fig. 52) is an excellent method, and deserves to be practised oftener than it is. Bring the middle of the material used under the part to be whipped, raise the ends

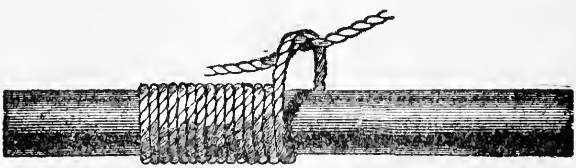


FIG. 52.—WEST COUNTRY WHIPPING.

and tie an overhand knot, lower the ends and tie another underneath; continue tying a single knot above and below alternately, finishing with a reef knot; or a round turn or two may be taken

FIG. 53.—CATSPAW.

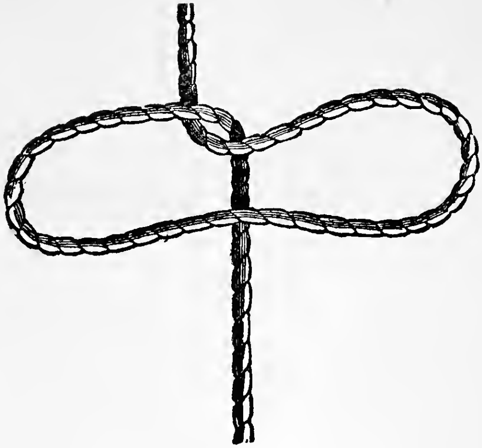


FIG. 54.—BEGINNING CATSPAW.

FIG. 55.—SECURING BLOCK TO ROPE.

and the ends may then be secured; but a reef knot is the most usual way of fastening off this whipping. This is not quite so neat looking a method as Figs. 49 and 50, but it is very strong and trustworthy, and is an excellent way of fastening large hooks, such as those used for cod or conger, on to a line.

A "catspaw" (Fig. 53) is used for attaching a rope to a tackle hook. Figure 54 shows how to begin it. A loop is made, and laid over the standing part so as to form two bights; these are rolled over two or three times, and the hook inserted in them. When the standing part is hauled upon, the hooks take the form shown in Fig. 44 (p. 327), and will not slip.

Figure 55 shows a way of securing a block to a rope with a selvage strop. The middle of the selvage is placed against the rope, and cross turns taken until the bights come together, when the hook of the block is put through them.

CHAPTER IV

Hammock Making

THIS chapter will describe the netting and slinging of hammocks.

Hammock making requires a netting needle of one of the shapes shown by Figs. 56 and 57. It may be made from a piece of $\frac{3}{16}$-in.

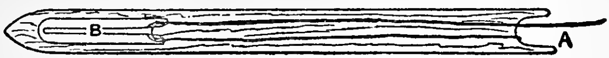


FIG. 56.—NETTING NEEDLE.

pearwood, beech, or boxwood about 8 in. long by $\frac{3}{4}$ in. wide. In needles as shown by Fig. 57 the cord is wound round as when filling an ordinary shuttle, and for Fig. 56 the cord is brought round the end at "A" up one side, round the pin at "B," and back

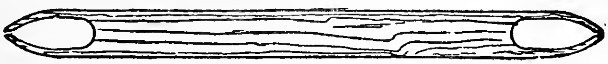


FIG. 57.—NETTING NEEDLE.

the same side, the process being repeated on the other side of the needle.

A mesh stick (Fig. 58) is made of hardwood or bone about 5 in. long and of an oval shape (Fig. 59); it may be about $\frac{3}{4}$ in. by $\frac{1}{4}$ in.

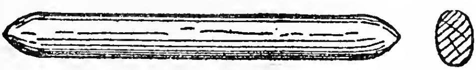


Fig. 58. Fig. 59.

FIGS. 58, 59.—MESH STICK.

in section. At one end of the string to be used for the net tie a loop "A" (Fig. 60), and place the knot on a nail or hook fixed in some convenient position, as at "A" (Fig. 61). Place the mesh stick under the loop as at "B," put the cord under it, then pass the

needle through the loop and pull the cord tight. Now place the thumb of the left hand on the cord beyond the loop as at "A" (Fig. 62), and with a turn of the wrist of the right hand throw the

FIG. 60.—LOOP IN MESHING.

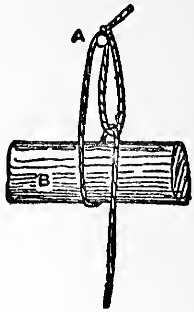


FIG. 61.—FIRST STAGE IN MESHING.

cord to the position shown at "B," then pass the needle under the loop "C," then through the bight of "B," and down as at "D,"

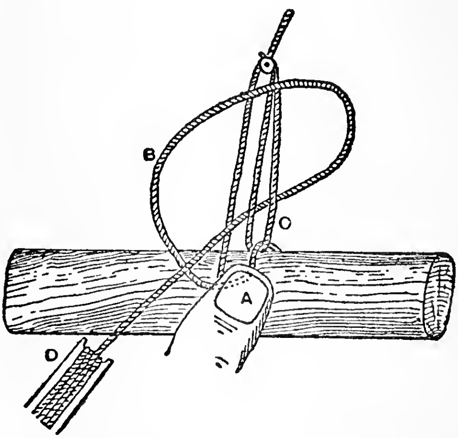


FIG. 62.—SECOND STAGE IN MESHING.

and draw the knot tight, which should then assume the shape shown by Fig. 63. The cord must be held firmly with the thumb

at "A" (Fig. 62) when pulling up the knots, as on this depends the uniformity of the meshes.

To continue the netting the stick is withdrawn and placed under "A" (Fig. 63), and the needle is then passed under the stick as in Fig. 61, and brought through the loop "B" (Fig. 63), and the process shown by Fig. 62 is repeated to form another mesh, this being continued to make a chain of meshes, say forty-five or fifty (Fig. 64), sufficient for the width of the hammock. The loop "A" (Figs. 60, 61–64) that was first tied is then untied, and it will then be found that all the meshes are equal in size.

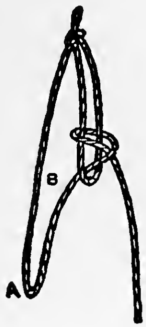


FIG. 63.—THIRD STAGE IN MESHING.

FIG. 64.—CHAIN OF MESHES.

Next the chain is opened out at right angles to the line in which it was made, as shown by Fig. 65, and working across is begun by making a mesh at "A" (Fig. 65), then at "B," "C," and so on, until the length of the first lot of meshes has been reached, when the net is turned over and another row of meshes worked until the one under "A" has been reached; then the net is turned again and another row worked, and so on.

The meshes are worked as shown by Fig. 62, but at first, to ensure uniformity, it will be well to put the loops "D" "E," "F," and "G" (Fig. 65) separately on the hook or nail as the meshes under them are made, but after a little practice a cord may be

reeved through the top line of meshes, tied into a loop, and passed over the knee and then over the foot, as the work progresses.

There are three ways of forming the ends. An ash stick may be used at each end to which the end meshes are looped and tied, and a piece of codline may be passed through the side meshes on each side and attached to the ends of the sticks. At each end a stout cord is secured to the stick in the form of a triangle for hanging the hammock. The second plan is to tie a number of cords

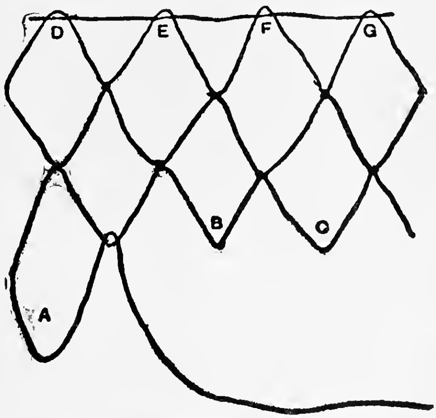


FIG. 65.—BEGINNING OF CROSS NETTING.

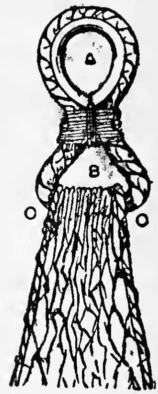


FIG. 66.—HAMMOCK CLEW.

together by doubling them in the center and forming a loop, and each of the free ends, known as "nettles," is attached to one of the meshes of the net. The third and perhaps the best plan is to reeve a cord about the size of a little finger through the end meshes and splice it into the form of a grommet as shown by Fig. 66. A thimble "A" is fixed in the end to which the supporting cords are attached, and the cords which are reeved through the side meshes are spliced into the eye "B" at "C." When these "clews" are used the net must be longer than for the sticks or nettles.

INDEX

H

J

K

L

M

N

P

R

S